THE MINERAL RESOURCES OF SOUTHEASTERN MANITOBA

RICE LAKE DISTRICT
OISEAU RIVER DISTRICT
BOUNDARY DISTRICT

BY
J. S. DE LURY

ISSUED AND DISTRIBUTED BY
INDUSTRIAL DEVELOPMENT BOARD OF MANITOBA

WINNIPEG
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INTRODUCTION

IN 1920 a bulletin on "Mineral Prospects in Southeastern Manitoba" was issued by the Manitoba Government. It contained a summary of information available at that time of the metalliferous deposits of Southern Manitoba. Since 1920 some new and interesting discoveries have been made and considerable development work has been done. It therefore seems desirable to incorporate in a new bulletin a report of recent finds and progress, together with the most important information contained in the earlier bulletin, which is now out of print.

All districts described were visited by the writer at different times and efforts were made to see the most promising mineral deposits in each. However, it was impossible to see all or to examine closely more than a few which were reputed to be of special interest. In compiling the information contained in this bulletin, the writer has consulted all available sources and notably the maps and reports issued by the Geological Survey of Canada. Special acknowledgment of these sources is made only in some cases. For the convenience of the reader a selected bibliography is appended.

Historical Outline

The part of Manitoba which first received attention from gold prospectors lies immediately west of the Lake of the Woods country. During the gold-mining boom in the nineties, which visited Western Ontario, several claims were staked on the Manitoba side of the boundary. During the same and some later years a little interest was taken in the gold-mining possibilities of the eastern shore and islands of lake Winnipeg and of the country tributary to Lac du Bonnet. In several years following these earlier activities there was little interest shown in the metalliferous prospects of the province. Some attention was, however, paid to non-metallic deposits.

Gypsum was first reported as occurring in Manitoba by J. B. Tyrrell in 1889. Production of gypsum was started twelve years later at Gypsumville and has been increasing fairly steadily up to the present time. Salt was recovered from brine springs, west of lake Winnipegosis, from early in the 19th century up to the coming of the railroads. Brick-making, building-stone production and cement manufacture have become established industries. Other non-metallics have also claimed attention but these have all been fully described by Dr. Wallace (21).

There was a revival of interest in metalliferous deposits when in 1911 gold was discovered in quartz veins on the shore of Rice lake, between Manigotagan and Wanipigow rivers. Since the first discovery, additional finds have been made in the same region each year and the known gold-bearing area has been gradually enlarged to one of great size. During the years of the war it became apparent that other parts of southeastern Manitoba contained interesting metalliferous deposits. Finds of tungsten and molybdenum ore were made in West Hawk and Falcon lakes area. Several deposits of copper-nickel ore were located in the vicinity of Maskwa and Oiseau rivers. During the past two years it has been learned that the country tributary to Winipeg and Oiseau rivers contains noteworthy lithium deposits. The chief development operations of recent years have centred around gold veins of Rice Lake district and copper orebodies of Oiseau river.

Geographical Features

Southern Manitoba will be described as that part of the province which lies south of township 45. This comprises the area of the original province, as it was prior to 1912, when northern Manitoba was added. This older part of the province is almost square in outline and has an area of about 72,000 square miles.

The waters of the area all find their way into lake Winnipeg which is drained by Nelson river into Hudson's bay. The lake has an elevation of 710 feet above sea-level. The country rises gradually from the east side of the lake to heights of over 1,200 feet near the Ontario boundary. To the west there is a very gentle ascent to the western escarpment, where there is a rapid rise of the country to elevations of about 2,500 feet.

The greater part of southern Manitoba is wooded, though there is a large stretch of prairie country in the basins of Red and Assiniboine rivers.

Geology

Leaving out of consideration the unconsolidated surface deposits, largely glacial drift, which occupy the greater part of the surface, the rocks occurring in Manitoba are conveniently referred to three major groups of formations. The oldest rocks, of Precambrian age, outcrop on the east side of lake Winnipeg and occupy the whole country east and southeast from there into Ontario. They also underlie the rocks of the other groups, which appear to the west and south of lake Winnipeg. Flat-lying Paleozoic limestones comprise the older of these. They

occur in wide bands striking northwest. Limestone outcrops are not numerous or large, appearing above the mantle of drift only on lake shores and in a few eminences. The other main group of rocks includes relatively soft Cretaceous sandstones and shales which cover the limestones in western Manitoba and outcrop prominently in the escarpment. A summary of the geological history of the region is interwoven in the following brief description of Precambrian, Paleozoic and Cretaceous formations. For an excellent general description of the geological features of Manitoba, the reader is advised to consult Wallace's bulletin (20).

PRECAMBRIAN FORMATIONS

The oldest, or Precambrian rocks outcrop in the eastern part of southern Manitoba. They also underlie the limestone formations farther west. These old rocks belong to the Canadian shield—a great area of Precambrian formations occurring in a wide U-shaped band around Hudson's bay and occupying the northern parts of the provinces of Saskatchewan, Manitoba, Ontario and Quebec. In southern Manitoba, outcrops of rock of this age appear from the Ontario boundary west to a line through the middle of lake Winnipeg and extended southeastward towards the corner of the province. West of this line, Precambrian formations are hidden by flat-lying limestones of Paleozoic age.

The nature and structures of the rocks in eastern Manitoba indicate the following major geological events in Precambrian time: Thick beds of lava and sediments were laid down on a floor, the nature of which can only be guessed at, because subsequent great changes have either effaced it or made it unrecognizable. The thick surface beds were folded into mountain ranges and were invaded from below by great masses of molten rock, which later cooled to form the large bodies of granite and granite-like rocks which now outcrop in the area. It is not known exactly how many mountain-folding movements and accompanying igneous intrusions affected the region. Most Precambrian areas have suffered from more than one such disturbance and it is probable that Manitoba areas have been invaded by more than one granite intrusion and have been affected more than once by major mountain-folding. Subsequent erosion, in late Precambrian, Paleozoic and later time, culminating in the glacial erosion of Pleistocene time, has reduced the area occupied by Precambrian formations to a peneplain. The ancient mountains were subdued and worn to their roots. Great areas of granite were exposed by this erosion and only remnants of the old thick covering of lavas and sediments are left. These

remnants are believed to be the synclinal portions of the folded crust. They appear in bands in the granite, commonly narrow but in places covering fairly wide areas. The strikes of the bands indicate the directions of old mountain ranges. These bands or remnants of the folded crust are typically composed of schists, which are rocks with pronounced lamination, an effect of folding, squeezing and other changes affecting the original lavas and sediments.

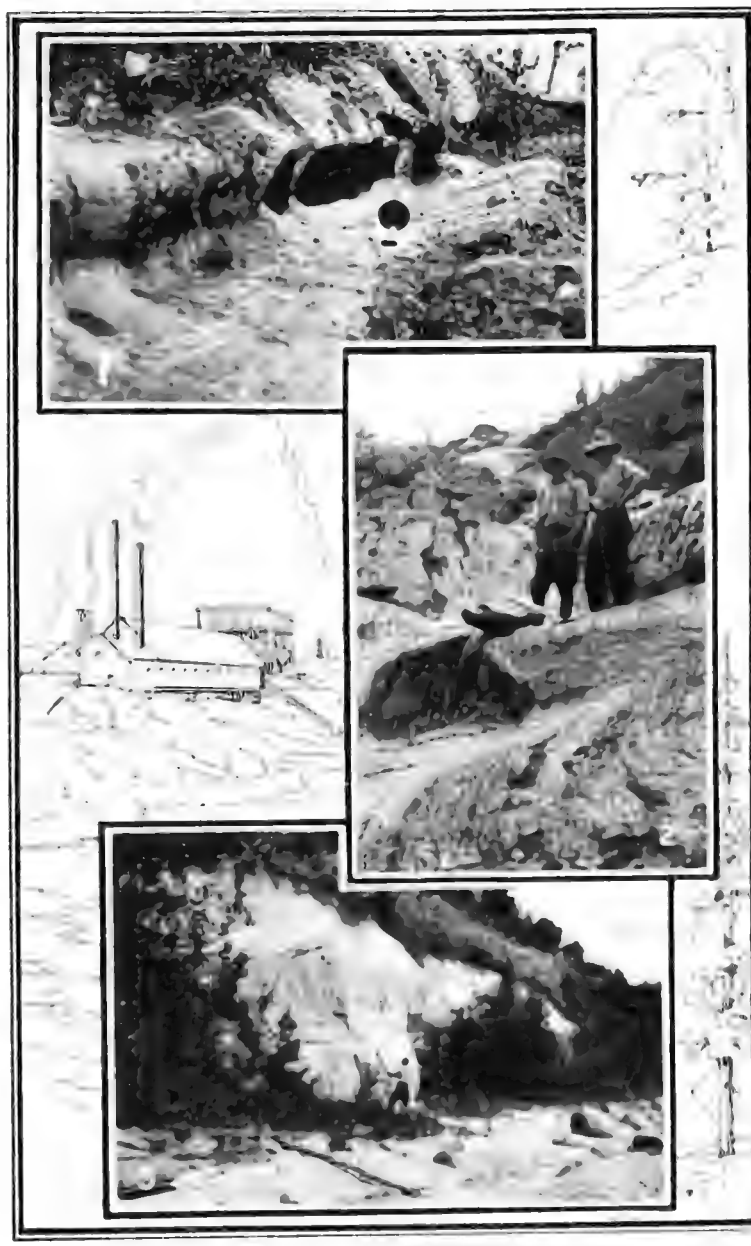
The end of Precambrian time marks the close of mountain-forming movements and of volcanic or other igneous activity, so far as Manitoba areas are concerned. Rocks formed since that time indicate no other earth movements than slow changes of level. Later, when the area was submerged by the Ordovician sea, the Precambrian highlands had been so reduced that granite became the most conspicuous rock at the surface.

PALEOZOIC FORMATIONS (Limestone, Etc.)

Flat-lying Paleozoic limestones occur in a wide northwest-southeast band of country, lying west of lake Winnipeg. Outcrops of the older and lower beds (Ordovician) are found on the west shore of that lake and in the limestone quarries at Stony Mountain and Tyndall. The base of the Paleozoic is commonly a sandstone, resting on a base-levelled floor of Precambrian rocks. Beds of Silurian limestone cover those of Ordovician age in the belt west of the latter. Outcrops are found at Stonewall and on the east shore of lake Winipegosis. The youngest Paleozoic rocks of Manitoba are Devonian limestones, which overlie Ordovician beds in a belt still farther west, which includes the basins of lakes Manitoba and Winnipegosis. All of these Paleozoic beds continue to the west but are there covered by thick beds of Cretaceous sandstones and shales. The limestones and associated sandstones and shales of Paleozoic age have a thickness totalling well over 1,000 feet in places, indicating that vast time, undoubtedly many millions of years, was required for their formation. They are the source of many of the non-metallic mineral products of the province.

CRETACEOUS FORMATIONS
(Sandstones and Shales)

Following the deposition of Paleozoic limestones, there seems to have been a withdrawal of the sea from Manitoba. No rocks of Carboniferous or early Mesozoic age are known in the province. There is a corresponding long lost interval in the geological history of the area. In later Cretaceous time, how-



1. Glacial Groove—Little Rice Lake Area—Rice Lake District.
2. Shear Zone—Gold Lake Area—Rice Lake District.
3. Winnipeg Sandstone Base of Ordovician—Black Island, Lake Winnipeg.

ever, the country was again covered by a shallow sea, in which were laid down thick beds of sand and mud. These beds have been cemented and compacted into the soft sandstones and shales which now outcrop in the escarpments of the western part of Manitoba. These formations, and it is probably true also of the limestones, originally covered most or all of southern Manitoba, but they have since been eroded from central and eastern areas. Cretaceous formations are also a source of some of the non-metalliferous economic deposits of the southern part of the province.

PLEISTOCENE (Glaciation)

Post-Cretaceaus time was another long and probably continuous period of erosion in Manitoba. It culminated in the ice-sheet erosion of Pleistocene time. During this period, the Great Ice Age, as it is called, the greater part of Canada was covered by ice-sheets, just as Greenland is occupied now. It can not be said how much of the total erosion was pre-Glacial or how much of it is to be credited to ice-work. The ice is no doubt responsible for the removal of practically all weathered material from the surface of Precambrian areas, and the surface topography throughout those areas is undoubtedly largely of glacial origin. It is probable, too, that great thicknesses of Cretaceous and Paleozoic beds were removed by the ice. The numerous lake basins and the profiles of practically all rivers of the province are most satisfactorily explained as the results of ice-sheet erosion. Exceptionally deep, rock-rimmed lake basins in unweathered Precambrian rocks indicate that in some areas at least, hundreds of feet of hard crystalline rocks were removed by ice.

More or less glacial drift appears in all parts of the area of southern Manitoba. Most of the limestone and much of the Precambrian are so deeply covered that even in large areas no rock outcrops appear. In the greater part of the Precambrian area, however, outcrops are numerous and the drift covering is deep only in valleys between hills and ridges. Here it is possible to prospect for mineral deposits, by examining the exposed outcrops or by removing a thin mantle of drift.

When the ice-sheets were retreating north, at the close of the Glacial period, waters collected in the great basin of southern Manitoba to form a large glacial lake, named lake Agassiz. This lake probably existed for many thousand years, long enough, at least, for the formation of lake beds which are in places about 100 feet thick. These lake beds cover the plains of southern Manitoba in the best agricultural areas.

General Economic Features

The metalliferous prospects of Manitoba are confined to Precambrian formations. Little hope is entertained for finding metals in workable quantities in Paleozoic limestones and Cretacious sandstones and shales within the province. On the other hand, all of these groups of rocks offer possibilities for a production of a variety of non-metallic minerals.

There are many kinds of structural materials available in all of the formations, but the limestones so far have been the prominent source. Quarries have been opened at several points in the limestone area, notably at Tyndall, Stonewall and Stony Mountain. Some quarries yield excellent dimension stone. Others provide good stone for burning, for crushing into road-metal and for use in cement manufacture. With the limestone formation are associated valuable beds of gypsum at Gypsumville and salt springs of a belt farther west. Structural materials are also obtainable from Precambrian and Cretaceous rocks, as well as from surface deposits associated with glacial drift.

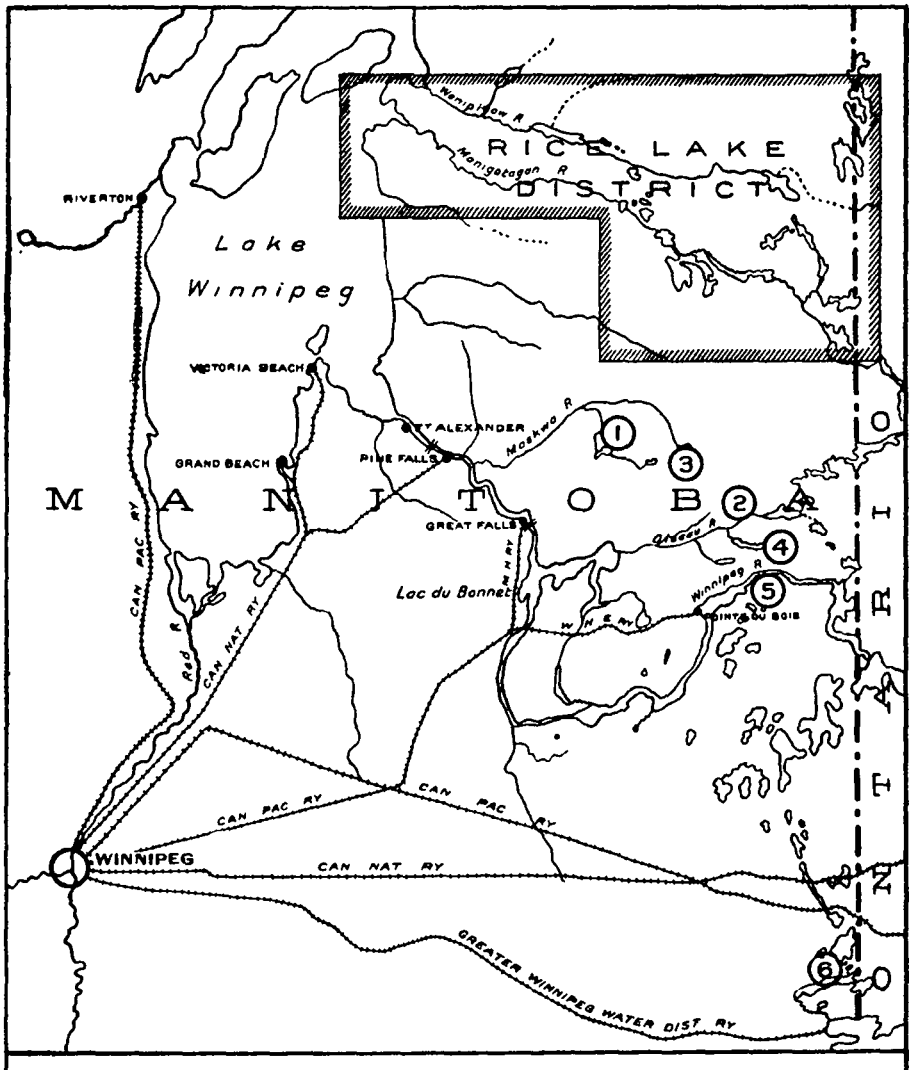
Lignite beds are found in a small area of Tertiary sediments, in Turtle Mountain, southwestern Manitoba. Oil shales occur in Cretaceous beds of the western escarpment.

The non-metallic mineral deposits have been described elsewhere (21), so that the space of this bulletin will be devoted mainly to a description of metalliferous areas. These are all in Precambrian rocks and located in the following districts:

Rice Lake District. An area lying between the south end of lake Winnipeg and the Ontario boundary, in the basins of Wanipigow (Hole) and Manigotagan (Bad-throat) rivers. The mineral deposits of this region are mainly gold-bearing and contain relatively small amounts of other metals.

Oiseau River District. An area including the country adjacent to this river and both north and south of it. The interesting mineral deposits contain copper and nickel, and others lithium minerals.

Boundary District. An area close to the Ontario boundary and west of the Lake of the Woods. It shows a great diversity of mineral occurrences, none of which have yet proved to be of commercial importance. Gold, copper, iron, molybdenum, tungsten and arsenic, as well as some other metals have created interest at different times.



INDEX MAP OF SOUTHEASTERN MANITOBA

Scale of Miles

0 5 10 15 20 25 30 35 40 45 50

LEGEND

1. Maskwa River Copper-Nickel
2. Oiseau River Copper-Nickel
3. Cat Lake Lithium Dep.
4. Bernic Lake Lithium Dep
5. Winnipeg River Lithium Dep
6. Boundary Dist.

RICE LAKE DISTRICT

The Rice Lake district includes a wide band of gold-bearing country, stretching east from the southern part of Lake Winnipeg to the Ontario boundary. Though this name for the district was originally applied to a portion of the country near Rice Lake, where the first discoveries of gold were made, custom has established its use to include all of the later additions to the earlier known gold-bearing area. The Rice Lake district is therefore regarded as including the whole mineral-bearing belt from Lake Winnipeg to the Ontario boundary.

Gold-bearing quartz deposits are fairly generally distributed in an area of about 400 square miles. The most westerly deposits are a few miles east of lake Winnipeg, and the most easterly are close to Ontario, near Wallace, Partridge (Moore), Bulldog (Beresford), Garner and Slate lakes. The metalliferous area lies in the drainage basins of Wanipigow (Hole) and Manigotagan (Bad-throat) rivers, and forms a belt parallel to these rivers, about 50 miles long in an east to southeast direction and from 5 to 20 miles wide. There is a fairly even slope to the country and a gradual descent from Ontario to lake Winnipeg. The highest waters inland have elevations of about 1,000 to 1,100 feet above sea-level. The level of lake Winnipeg is 710 feet. Rapids and falls are numerous on the rivers, making water transportation difficult. The country is practically all forested, though not heavily timbered except in a few small areas. There has been much destruction by forest fires in some parts.

Precambrian rocks outcrop conspicuously in some localities, sparingly in others. As a rule the most numerous and largest rock exposures are in the higher areas, notably in the eastern part of the belt and near the divides between drainage systems. The lower lands, particularly those to the west near lake Winnipeg, are commonly covered by considerable thicknesses of glacial drift and lake-beds.

History of Development

In a report (15) written in 1912, E. S. Moore gives a summary of what was known then of the economic possibilities of the Rice Lake district. The following are extracts from this summary:

"For a good many years iron has been known to exist on Black Island, in lake Winnipeg, and some gold prospects have been exploited along the shore of the lake in the vicinity of Wanipigow and Manigotagan rivers, but the latter have been practically all abandoned. In March, 1911, Capt. A. E. Pelletier discovered the claim on Rice lake, known as the Gabrielle, and

the areas which have since attracted attention are those adjacent to Rice lake and Wanipigow river to the north of this lake, one on Long Lake and one on the small lake north of Eagle Rock lake.

"The only claim in the region upon which any development work worth mentioning has been done, is the Gabrielle, the first claim discovered.

"The veins described above (Gabrielle and similar ones on Rice lake) are the most important ones found in the region, but there are many others of smaller size or apparently quite barren, scattered through this area. There are some around Horseshoe lake, some north of Wanipigow river, and some on Elbow lake, where a large mass crosses the lake at the narrows near the north end. On Wallace lake, near the northwest corner, there is a mass of white barren quartz about 30 feet in diameter lying near the granite contact."

Moore also mentions the occurrence of iron-formation, of some pyritic schist on Oiseau river and describes some occurrences of quartz on Long lake.

In a bulletin (9), published in 1920, the present writer summarizes the progress to that date of the district as a whole, in the following words:

"Since 1912 steady prospecting has been carried on by a small number of prospectors and over 2,000 claims have been staked in the area, almost all for gold. On several of these claims mining operations have been initiated at different times, the most extensive developments of the earlier years being carried on in the vicinity of Rice lake, and in later years near Gold lake and east of Wanipigow lake. A good deal of work has been done throughout in exposing the surfaces of veins, by stripping and by means of shallow trenches and pits. A large number of claims have been staked for location and, as is to be expected in such cases, they have generally no showings of interest and the work which has been done on them is of little importance.

"The extent of major operations in the district as a whole is indicated by the fact that of eleven claims, each has underground workings of over 100 feet, and together they have a total of over 2,300 feet, giving an average of more than 200 feet. Minor developments represent about an equivalent amount of work."

Since 1920, each year has recorded additional discoveries of gold-bearing veins and further extensions of the mineral-bearing area. Some serious efforts at underground development have been made. With one important exception, the scene of major operations has shifted in these years from the older known parts

of the district to the extreme eastern part, near Long and Bulldog lakes. Underground developments are still in progress on a few important deposits and the area appears at last to be entering on the producing stage.

Geological Features

In the Rice Lake district the rocks found outcropping through the surface mantle of drift and other unconsolidated materials, are all of Precambrian age. The rocks in these outcrops are remarkably fresh-looking. In Pleistocene time the ice-sheets removed all previously existing weathered rock and there has been very little weathering since their retreat. In most outcrops glacial striae are still clearly discernible.

Schists of sedimentary and volcanic origin are areally distributed in narrow to wide bands and irregular bodies between areas of granites, diorites and other plutonics, which are massive in some parts and gneissic in others. Wherever the relations are clear, the plutonics are always intrusive into the schists. Typically the bands of schist strike between east and southeast and the laminations are parallel to the bands. Locally, however, the schist bands strike in other directions and the laminations are contorted and show many changes of strike. The dips of the schists also vary greatly from place to place, but they are much more commonly nearly vertical in attitude than horizontal.

It is true of this as for most Precambrian areas in Canada, that the structures of underlying rocks have determined the nature of glacial erosion to such an extent that topographic features, such as lake basins, rivers and rock ridges, are more or less definite expressions of rock structures.

As a result of field-work done in the vicinity of Rice Lake in 1922, J. F. Wright (22) gives the following classification of Precambrian rocks found in the area. Age relationships are not always clear, but generally older formations are placed below younger in the table:—

Dyke intrusives	Diabase
	Feldspar and quartz porphyries.
Granite intrusives	Pink hornblende granite.
	Granite, granite porphyry, grandiorite, syenite.
	Banded gneisses.
	Granite and Granite gneiss.
Sedimentary Series	Arkose, quartzite and conglomerate.

Probable sedimentary series..	Biotite schist and garnet gneiss.
Volcanics with some interbedded sediments	Cherts, slates and volcanic tuffs.
	Rhyolite, feldspar porphyry and sericite schist.
	Trachyte, andesite, andesite porphyry and chlorite schist.
	Basalt, basalt porphyry and diabase.

The schists have many points of resemblance to others ascribed to Keewatin age in many parts of Ontario. However, it is possible only to give relative ages of the different formations in a district such as Rice Lake. Definite correlation with similar formations to the southeast is impossible in the present state of knowledge. These remarks apply also to the formations indicated in the following condensation of Wright's classification for the eastern part of the district, worked out by him in 1923:

Granite intrusives (youngest).
Basic intrusives.
Volcanic series.
Sedimentary and interbedded volcanic series.
Sedimentary series (oldest).

Detailed descriptions of these formations are found in Wright's report (23), which is accompanied by an excellent map showing the outcrops of the different members.

Mineral Deposits (General)

Gold-bearing quartz veins and shear zones are the only metalliferous deposits of economic interest so far discovered in the Rice Lake district. Gold is found in a great number of places, in a mineral belt about 400 square miles in area. Some general features will be considered before the several areas and occurrences are treated in more detail.

Gold deposits are found in practically all of the prominent rock formations of the district: notably in the schists of igneous origin; also in granites, diorites, etc., and their associated porphyries, which are gneissic in places but are typically more massive than the schists.

Too little is known concerning the number of batholithic invasions of granitic and other magmas, and of the relations of the rocks so produced, to permit the designation of any one of them as being responsible for the gold concentrations. The great uniformity in the materials of the ore-deposits throughout the district indicates only one period of metallization and therefore a connection with only one igneous invasion. Moreover, there are no indications of crustal disturbances subsequent to the formation of gold veins and shears. It is therefore probably true that the gold concentrations will be traced to a single late batholithic intrusion, which produced the youngest granitoid and porphyritic rocks of the region.

Quartz is invariably present where gold values are secured and it typically forms the bulk of the deposit. Commonly the country rock adjacent to the quartz is silicified or partly replaced and contains the same ore minerals as the quartz. Ankerite and other carbonates are abundant in quartz and altered rock in some deposits, but lacking or in small amount in others. Pyrite is present in all deposits but varies greatly in relative quantity from a barely perceptible trace to a heavy sulphide ore. Chalcopyrite is also present in nearly all deposits, traces in some and conspicuous in others. As a rule, the highest gold assays come from ores in which chalcopyrite is a prominent sulphide. Free gold is practically the sole economic mineral of the district. Tellurides occur but precious metal tellurides are not anywhere conspicuous. Pyrrhotite is rare and entirely absent from many deposits. Arsenopyrite is not a common mineral and is nowhere abundant. Small amounts of sphalerite, galena and molybdenite occur in some deposits. Tetrahedrite has been found in one locality. Feldspar, white and green micas and tourmaline are also found. On the whole the latter minerals are not abundant, but locally any one of them may be a prominent constituent of the ore.

The gold deposits present a wide variety of forms. Some bodies, usually small, are in simple fissures of very local development, without signs of much movement between walls. There are all gradations in form from these to great shear zones, some of which are traced for several thousand feet and up to a mile or two. In the typical shear zone the country rock has been sheared by movement into a finely laminated schist. Quartz has invaded the shear zone, coming in under great pressure in concentrated siliceous solutions or ore-magmas, filling openings made between sheared layers of rock and replacing the sheared rock. The quartz in shear zones occurs in many forms. In some occurrences a great mass of quartz, 10 to 20 or more feet wide, occupies the whole width between the walls of the zone. The length of such a mass along the shear is usually not great.

Typically quartz is distributed throughout the shear zone as a series of veinlets, veins and lenses, comprising in some places but a small fraction of the width of the zone, but in others over half of the zone. In the most promising economic deposits, it is common to find a large vein of quartz occupying a prominent part of the shear for a considerable distance along the strike. Where this vein thins out at an end, commonly a new vein appears in another part of the shear zone, which may in turn widen out to form another conspicuous vein. Typically workable ore is not continuous along a shear and much development work may be needed to define the boundaries of workable shoots.

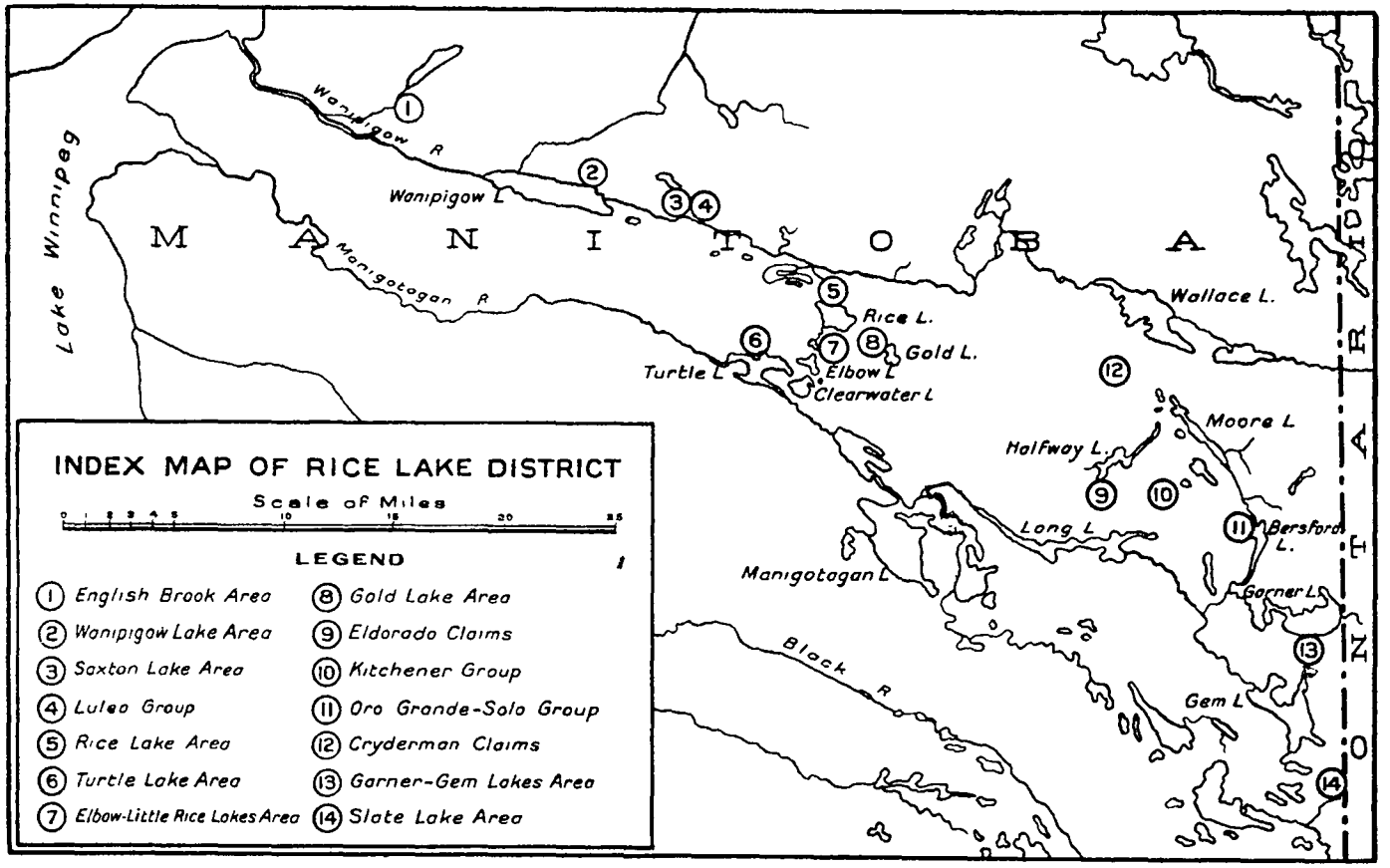
The most regular shear zones are those in which the shearing is parallel to the prevailing strike and dip of the schistose or other structures in the surrounding rocks. Such zones are relatively tight and the quartz in them forms a small part of the zone and is commonly distributed in narrow stringers. The best conditions for the formation of large bodies of quartz seem to be supplied when the shearing direction makes an angle, usually a small one, with the surrounding structures. In these quartz is apt to be developed strongly in a series of relatively wide lenses.

The gold occurrences of the district will be described in groups referable to prominent localities. In a general way, the most westerly occurring deposits are mentioned first and the eastern fields, the scenes of most recent important developments, will be described last, after the following plan:

Area north of Wanipigow river
Deposits near English Brook.
Deposits north of Wanipigow lake.
Deposits near Saxton (Hay) lake.
Luleo group, and surrounding claims.
Turtle Lake area.
Rice Lake area.
Elbow and Little Rice (Red Rice) lakes area.
Gold Lake area.
Long-Beresford lakes area.
Outlying gold discoveries.

AREA NORTH OF WANIPIGOW RIVER

Claims have been staked and gold is reported as being fairly generally distributed in a belt of country a few miles wide along the north side of Wanipigow river and lake, stretching from the lower part of English Brook southeastward to the country north


Lake Winnipeg
Wanipigow R
Wanipigow L
Manigotagan R
MANITOBA
Rice L.
Wallace L.
Gold L.
Elbow L
Turtle L
Clearwater L
Moore L
Halfway L.
Long L
Bersford L.
Manigotagan L
Garner L
Black R
Gem L
ONTARIO
INDEX MAP OF RICE LAKE DISTRICT
Scale of Miles
0 1 2 3 4 5 10 15 20 25
LEGEND
(1) English Brook Area
(2) Wanipigow Lake Area
(3) Saxton Lake Area
(4) Luleo Group
(5) Rice Lake Area
(6) Turtle Lake Area
(7) Elbow-Little Rice Lakes Area
(8) Gold Lake Area
(9) Eldorado Claims
(10) Kitchener Group
(11) Oro Grande-Solo Group
(12) Cryderman Claims
(13) Garner-Gem Lakes Area
(14) Slate Lake Area

of Rice lake. The deposits reputed to be of chief interest in this belt will be described in order from west to east, in groups related to prominent localities.

Deposits near English Brook.—The most promising area in the vicinity of English Brook lies to the southeast of the lower stretch, between English lake and Wanipigow river. A road has been cut from a place just below the lowest rapid on Wanipigow river, northeast about 5 miles to the Ling and Betty claims.

The more westerly deposits include mineralized shear zones on the Lotus, Ling, Denver and Dominion claims. The shears are generally in porphyries and felsites and strike roughly north and south. On the Ling claim, quartz is prominent in a few hundred feet along the length of a strong shear zone. Free gold is prominent in many parts of the quartz. Chalcopyrite and tetradymite, a bismuth telluride carrying some selenium, are also present. Pyrite is disseminated prominently in both quartz and surrounding country rock. At the time the property was examined a prospecting shaft was being started, following the vein which dips to the east. There are similar deposits on the Lotus, Denver and Dominion claims but none were being developed in the summer of 1926. Promising gold values are reported from them but more work will be needed to prove up a workable body of ore. The mineralization in all of them is much like that of the Ling, though telluride has been reported as occurring only in the Lotus deposit.

East of the claims just mentioned there is a long and strong shear zone in diorite and coarse porphyry associated with basic schist, appearing on several claims. It is prominently exposed at the east end on Betty 6 claim, from which it strikes west and outcrops show at intervals on Betty 3, Betty 1 and Bingo 3. Quartz is very prominent in some parts of the shear and it and the associated country rock are locally well mineralized with sulphides. There is a marked variation in mineral composition from place to place in the shear zone, both along the strike and from wall to wall. The common sulphide is pyrite. In one section across the shear on Betty 6, where the zone is very wide, arsenopyrite is prominent in one part and grey copper (tetrahedrite) in another. Underground operations are contemplated for the Betty group and machinery is being moved to the property. Towards the western part of the shear zone, there is a prominent outcrop exposed for a short distance on Bingo 3 claim.

A shear zone containing considerable quartz and schist mineralized with pyrite and arsenopyrite occurs on the Wana group of claims, about 2 miles east of the Betty camp. Occurrences of free gold in several deposits near English lake indicate that the gold-bearing belt has considerable width. Gold has also

been found on many claims staked in the same belt all the way to the east between the deposits just described and the next group to be mentioned, namely, the one north of the east end of Wanipigow lake.

Deposits north of Wanipigow Lake.—Though gold is known to occur on several claims north of Wanipigow lake from west to east, the most attractive deposits so far found are north of the east end. The writer visited these in 1919 but Wright examined them at a later time (1922) and his description (22) will be quoted:

"The mineral claims in this group are in township 25 and are from 2 to 4 miles north of Wanipigow lake. Prospecting has been done mostly on the Huronic, Windsor, Bondholder, Rhoderick, Amisk and Proctor claims, but consists only of a few trenches to prove the extent of the sheared zones along their strike, and a few shallow pits. The country rock of the whole area is coarse-grained, massive granite, granite porphyry and granodiorite with many schist inclusions. . . . .

"The strongest shear zones strike north 60 degrees west, parallel to the south contact of the granite area north of Wanipigow river and also nearly parallel to the general strike of the important shears on the Luleo and Saxton lake groups . . . .

"On the Huronic claim the shear zone averages about 4½ feet in width and the quartz 2 feet in width for about 200 feet along the strike. In the quartz there is some pyrite, considerable chalcopyrite, a little free gold and a gold telluride. The sulphides are reported to assay as high as $120 a ton. The shear zones and quartz veins on the Bingo and Bondholder claims are narrow, but can be traced for several hundred feet on the surface and contain free gold. On the Rhoderick claim a quartz vein about 2 feet wide can be traced for over 100 feet along the contact between granite and a sheared and slightly mineralized schist inclusion. It was thought that this inclusion might contain values, but an assay of an average sample did not show even a trace of gold. The shears of the Proctor and Amisk claims averaging over 6 feet in width are continuous along the strike for 2,000 or 3,000 feet or more, and contain considerable quartz, but assays show low gold values."

Deposits near Saxton (Hay) Lake.—Saxton or Hay lake is about 3 miles northeast of the east end of Wanipigow lake. Numerous claims have been staked in this vicinity but extensive development work has not been done on any of them. Acid granitoid and porphyritic rocks form most of the outcrops, though inclusions or roof-pendants of schist are numerous. The most interesting group of claims is located to the south and east of Saxton lake. Wright (22) describes the deposits on these

claims as follows: "About a dozen shallow pits have been sunk on the quartz veins and some of the sheared and fractured zones can be traced several hundred feet along the strike, in one case over 2,500 feet. The general strike of the most important exposed shear zones is north 50 degrees west . . . . Quartz is not abundant along any of the shear zones in this locality and the sheared and fractured zones average only about 2 feet in width. In some places the quartz is mineralized with pyrite, chalcopyrite, arsenopyrite, galena and sphalerite. Assays are reported to average about $17 in gold a ton across widths of 3 feet, but only for short distances along the strike. In September, 1922, there was no evidence of any considerable tonnage of ore on any of the claims visited, but systematic development may prove deposits large enough and rich enough to be payable."

Luleo Group.—The area including the Luleo group and surrounding claims lies 2 to 3 miles east of Saxton lake and an equal distance north of Wanipigow river. For a number of years up to 1925, it was the scene of the outstanding underground development work in the Rice Lake district. From a shaft located on Luleo 2 claim, in the neighborhood of 3,600 feet of shaft, drifts and cross-cuts were made. This work is probably more than equal to the total of the earlier underground work in the whole district.

The rocks outcropping in this area are mainly granites with inclusions of schist. Outcrops are not large or numerous owing to a relatively thick accumulation of drift and an abundance of muskeg. Shear zones, striking generally about southeast are numerous. The proportion of quartz and of sulphide mineralization varies greatly in the shear zones. A description of the deposit in Luleo 2 and adjoining claims, on which underground work was done, and which has the greatest quantity of quartz exposed, will serve for the area.

On Luleo 2 a wide shear zone shows a width of 20 to 30 feet of quartz for a length of over 300 feet. The shear, which is in granite, passes into low covered ground to the northwest and southeast. In the latter direction, it is picked up 700 or 800 feet away on Luleo 3 claim. Another extension is found on the surface to the northwest. A depth of over 500 feet was reached below the main outcrop and drifts and crosscuts on five different levels have explored the shear zone underground in a length of over 1,000 feet. The main vein and other bodies of quartz swell and pinch from place to place. The width of quartz in the shear zone varies from very narrow to over 60 feet. The bulk of the quartz shows only traces of gold and the chief values appear to follow a zone within a few feet of the foot-wall. Values were obtained on the outcrop, near the hanging wall, but in underground development, this wall was comparatively neglected.

Most of the quartz shows no sulphides. Pyrite is locally prominent, particularly near the foot-wall, where the adjacent schist is commonly impregnated with sulphide. Small quantities of chalcopyrite, arsenopyrite, galena and sphalerite are also noted in places. Free gold may be panned from the richer ore near the foot-wall. The chief values appear to be in a vein of dark-colored quartz, which follows the foot-wall and has a width of a fraction of an inch to 5 or 6 inches. This rich band is not very persistent, but it can usually be depended on to yield a tail of gold and fine sulphides, when panned. Quartz is the predominant gangue mineral. Ankerite and other carbonates are prominent in some patches and bands. Sericite is common but not abundant. A green chrome mica, mariposite, is conspicuous in places on account of its vivid color.

The later and more extensive development on the Luleo claims was carried on since the property has been in the hands of the Selkirk Gold Mining Company. The work was financed for the great part in New York. Undoubtedly some ore worth milling has been developed in the mine, though the quantity has not justified further work under the handicaps now offered by the area. If further exploratory work is contemplated, diamond-drilling might prove to be the most economical method.

The country lying to the east of the Luleo claims is deeply drift-covered. A few discoveries of gold and a few outcrops, however, indicate that it is promising country for the more expensive kind of prospecting, once the district as a whole enters the producing stage. There is a prominent mineralized shear in volcanic schists on the Luana claim, about 2 miles east of the Selkirk mine. Free gold is prominent in narrow quartz veins occurring in a strong shear zone which has been exposed for more than 100 feet on the Syndicate claims, about 3 miles east of the Luana. The shear zone has an east-west strike and occurs in acid and intermediate volcanic schists, the laminations of which strike south of east.

TURTLE LAKE AREA

The existence of gold-bearing deposits in an area north and within a few miles of Turtle lake has been known of for several years. The greater part of this country is occupied by granite, though a narrow east and west belt of schist lies not far north of the lake and carries some mineralized shear zones. The most interesting deposits of this area are, however, in granite. Mineralized quartz occupies a prominent part of several well-defined shear zones traversing this rock. Some shears strike east and west, and another prominent direction is north, 70 degrees west.

As a rule the quartz bodies are persistent and well defined, but are not large.

On the Eva claim a quartz vein has been traced for about 1,000 feet and exposed for 800 feet. The shear zone varies in width from 2 to 10 feet and the quartz from a few inches to 3 or at most 4 feet. The quartz is not heavily mineralized but traces of pyrite and chalcopyrite are generally apparent in hand specimens. Free gold occurs, particularly near showings of chalcopyrite. A shaft has been sunk on this claim to a depth of 100 feet. The quartz vein is said to be 6 feet wide at the bottom of the shaft, without encouraging values. The quartz is fine-grained and shows a sheeted or banded structure.

Deposits similar to that on the Eva claim appear on the Thora and Falcon No. 1 claims. Others with more massive quartz and less uniformly distributed sulphides occur on the White Rock and Apex claims.

RICE LAKE AREA

It was in the vicinity of Rice lake that the first gold discoveries were made and the first development operations were carried on, so that the name, besides being used for this immediate area, is also used for the whole district.

Rice lake lies in the middle of a belt of schists which strikes about southeast. The basin of the lake is occupied by a narrow belt of sedimentary schists. North of these and occupying the north shore are volcanics of several types, some massive but most of them schistose, and in these rocks are the principal gold deposits of this area. The gold occurs in veins, stringers, lenses and irregular masses of quartz and other gangue minerals, occupying shear zones and brecciated areas and bands. A few of the more prominent occurrences are described.

On the Gabrielle claim underground work was done in the earlier years of development. A deposit near the northwest shore of Rice lake shows a fairly wide outcrop of mineralized rock containing many intersecting veinlets of quartz. The deposit is very irregular and as it passes into the lake at the east end and under cover to the west, its attitude is obscure. There is some evidence of shearing, but the general structures indicate brecciation in the mineralized zone, rather than flowage. Pyrite is present in the quartz and is even more prominent in the rock materials of the deposit. Iron-bearing carbonate and reddish-weathering feldspar are very generally distributed. There is also some gray and black tourmaline. A shaft was sunk on this deposit to a depth of 52 feet, at which level a curving drift was run for 38 feet.

Another prominent outcrop on the Gabrielle appears in a well-defined shear zone which strikes about north, 40 degrees west. The schistose porphyry, in which the deposit lies, has a strike nearly east and west. The sheared zone is occupied by more or less mineralized schist, and by a succession of bodies of quartz in many forms and sizes. The typical quartz outcrop suggests a fairly regular vein or lens and is commonly traced for a hundred feet or more along the strike. Groups of parallel stringers and very irregular masses also occur. The deposit as a whole is traced intermittently for several hundred feet. Sampling widths vary typically from 4 to 10 feet, with an average of about 6 feet. Compared with the other outcrop of the Gabrielle, this one is more typical of the common shear zone of the district, its structure suggesting flowage rather than fracture. The deposit is mineralized much like the other one. A shaft was also sunk on this outcrop, to a depth of 66 feet. At the bottom there is a cross-cut of 4 feet and drifts: one to the southeast for 12 feet and another to the northwest 60 feet. Careful sampling has indicated that the Gabrielle might be worked if power and transportation facilities are improved in the district.

A short distance east of the Gabrielle deposits there is an interesting occurrence of similar character on the San Antonio claim. In the earlier days of Rice lake development a shallow open cut near the lake shore exposed a quartz vein with an average width of about 3 feet, together with other smaller veins and a fractured zone in diabase showing sulphides in the fractured rock and associated veinlets of quartz. Careful sampling of outcrops near the lake shore indicated values sufficiently good to warrant further work in exposing the outcrop. In 1927 the fractured zone was followed by stripping and trenching northwest, practically across the claim. Prominent but irregular quartz veins and lenses appear nearly everywhere in the fracture zone. Free gold is prominent in many places. The mineralization resembles that of the Gabrielle deposits.

Plants were erected and some underground work was done on a number of claims lying east of the San Antonio. This work immediately followed the earliest discoveries, so that the plants are now run down or dismantled and the underground workings are inaccessible. The most prominent of these claims are the Goldfield, Gold Cup, and Big Four, lying north of Rice lake, and the Ranger, a short distance to the southeast of the lake.

Many other discoveries have been recorded in the Rice Lake area and it is possible, that with more intensive surface prospecting, some interesting deposits will be proved up.

ELBOW AND LITTLE RICE (RED RICE) LAKES AREA

Many claims have been staked near Little Rice and Elbow lakes. The most promising deposits occur in an area lying within 2 miles to the east of the lakes. The rocks consist mainly of schists derived from acid to basic, felsitic to porphyritic lavas. The laminations of the schists strike commonly between east and southeast. Granite outcrops prominently a few miles away to to the west, south and east, and not much farther (about 4 or 5 miles) to the north. The prominent occurrences of gold-bearing quartz are in wide shear zones, some of which are parallel to the laminations of the enclosing schists, but most of which cut them at small angles. The main shear zones are fairly persistent in length, being commonly traced for several claim lengths. They are well defined but vary greatly in width from place to place. The quartz bodies in the shears form regular veins and lenses in some places, but in others vary greatly in form. They show a similar diversity in size. Schist mineralized with sulphides is a common associate of quartz in the shears. In many places the shear zone is large enough and mineralized quartz is prominent enough in the zone to warrant exploration for values. Many of the outcrops have been exposed for sampling, and a few have been sampled and have not proved to be encouraging.

The Tine claims show a wide sheared zone striking about east and west and traced across two claims. Quartz is prominent in the shear, wherever it has been exposed by stripping. It makes an average width of about 4 or 5 feet across the shear, but is typically split up into two or three major veins and numerous veinlets. Much of the schist of the shear contains disseminated pyrite. Pyrite and chalcopyrite are prominently and fairly uniformly distributed through the quartz.

On the Montcalm and adjoining claims there is a similar wide shear zone. The quartz is more irregularly distributed and sulphides, though prominent in places, are absent from much of the zone. Free gold, similarly, is sporadic in occurrence. Great masses of quartz are locally exposed. Over 20-foot widths occur in lengths along the shear of 40 or 50 feet. One mass is over 50 feet wide. Other parts of the shear show a total of 2 or 3 feet of quartz in considerable lengths.

The Wolf claim shows a zone similar to that of the Montcalm. Quartz, sulphides and free gold are irregularly distributed. Locally there are pits showing rich ore, surrounded by relatively low-grade or even barren quartz.

Similar shear zones with varying amounts of quartz and of sulphide and gold mineralization, appear on other claims in

the vicinity. Prominent among these claims are the Gilbert, Chappelow, Bears, Fisher, Yankee Girl and Martin.

GOLD LAKE AREA

An area lying northeast of Clearwater lake and stretching from its shore a distance of 3 or 4 miles to the vicinity of Gold lake, is included in the Gold lake area. The country here is occupied mainly by schists of volcanic origin. Granite and granite porphyry appear in a narrow belt along the northeast shore of Clearwater lake and in a wide area east of Gold lake.

The veins and shear zones are largely in volcanic schists but there are some noteworthy occurrences in granitic rocks. Gold-bearing deposits are typically in narrow to wide zones of sheared rock. Many of the occurrences of this area, however, are small veins occupying fissures formed with little or no shearing in the surrounding rock The latter are generally crooked, variable in width and difficult to trace, but may carry abundant free gold. A few of the deposits on which considerable work has been done, are described; others are only mentioned.

The deposit on which most development work has been done is the one on which the Gold Pan, Gold Seal and Gold Pan Extension claims have been staked. A fairly continuous but narrow body of quartz follows a shear zone in acid volcanic schist, striking northwesterly. The shear zone varies in width from 1 to 8 feet and is traced for over 3,000 feet. It is nearly vertical in attitude. Quartz varies greatly in the proportion of the shear zone that it occupies. Lenticular bodies are traced for lengths of 50 or 100 feet with widths of 2 or 3 feet. Greater widths are exceptional. Wider lenses are joined by stringers along the strike of the shear, but the average width of quartz is less than 1 foot and probably nearer 6 inches. The quartz is unevenly mineralized. Sulphides, nowhere prominent, are scarce or absent for notable distances along the strike. Free gold is very prominent in a few places. The most prominent sulphide is pyrite, which occurs not only in quartz but in associated schist. Chalcopyrite and traces of sphalerite and galena appear here and there in quartz. Some exceptionally rich samples of free gold in quartz have come from underground workings, notably from a shaft on the Gold Pan. This shaft was sunk near a place where the vein crosses a dike of basic rock and it is possible that the best values in the vein are localized near this dike. The vein is too erratic in size and values to be worked as a continuous ore-body. The only possibility for an economic production from it would seem to lie in locating pockets of bonanza ore, which might pay more than the cost of locating them.

Underground operations were carried on a few years ago on all three of the Gold Pan, Gold Seal and Gold Pan Extension claims. Depths of over 200 feet were reached and considerable drifting was done. These workings throughout indicate that size and values at depth are about what would be expected from the outcrop.

The Gold Pan group lies about 2½ miles east of Clearwater lake and a mile south of Gold lake. A little over 1 mile to the southeast of the Gold Pan and close to the contact of a large body of granite which outcrops to the east, is the Moose claim, on which in the early days considerable work was done. A prominent shear zone strikes across the Moose claim, northwest into adjoining claims. The zone is irregular in width and strike. It is traced into the granite for some distance but the most promising part of it is in porphyry schist. Veins of quartz, mostly lenticular but some of them fairly continuous, occur here and there in the great shear zone. In general the quartz and adjacent schist show some sulphides and in places sulphides and gold are very prominent. Values are distributed very erratically. In 1916 a shaft was sunk on one of the larger and more persistent bodies of quartz to a depth of 100 feet. Drifts were run on that level, 71 feet to the southeast and 108 feet northwest. The quartz vein is continuous throughout the workings and shows a width varying between 2 and 6 feet. The Moose deposit has not been examined exhaustively and it is possible that similar operations on other parts of the shear might expose more encouraging values.

Other prominent shear zones appear in the Gold lake area. Perhaps the most conspicuous one of these is traced from the Canadian Girl claim southeast across the Pilot, Jumbo, Smuggler and Lucky Strike claims. Stripping, trenching, pits and shallow shafts have exposed the shear sufficiently to permit sampling. This Pilot-Smuggler shear zone is so large and continuous and carries so much mineralized quartz and schist, that it offers every inducement for a careful search for valuable ore.

The Pilot-Smuggler shear zone lies about midway between the Gold Pan group and Clearwater lake. Close to the Gold Pan and to the west of it there is another noteworthy shear zone outcropping conspicuously on the Josephine and Mildred claims. This shear strikes north, 17 degrees west. Throughout it contains bodies of quartz of many forms and sizes. Sulphides are prominent in both quartz and schist. More than 1,000 feet along the strike is well exposed for sampling.

Other shears are found in the vicinity of Gold Lake, among which might be mentioned those on the Somme, Eagle, Jumbo, Irene, Brooklyn, Chicamon and Nevada claims. Farther east

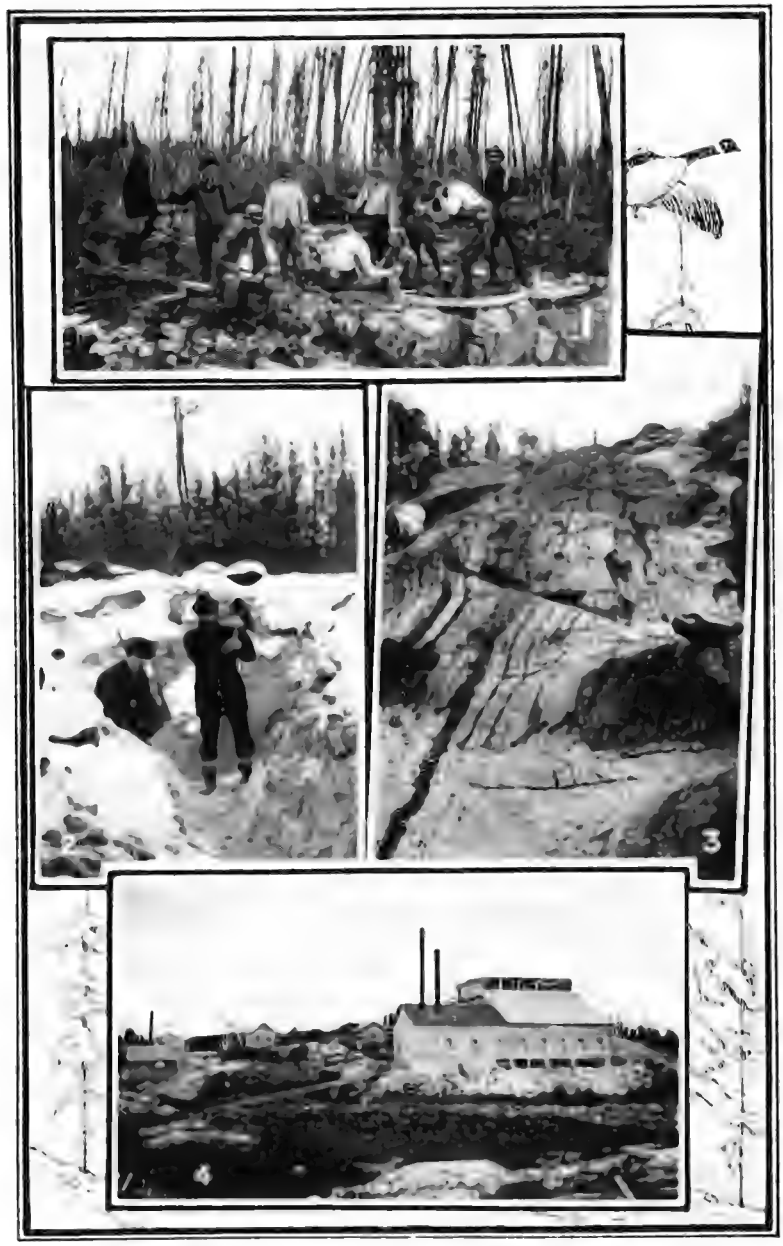
rich gold-quartz has been found in shears, fractures and fracture zones in granite or affiliated rocks on the Commonwealth, Exchange, Harry, Bruce and other claims.

The Pendennis claim on the north shore of Clearwater lake also shows a deposit in granite or granite-porphyry. Here a small but rich vein of quartz has been exposed for a distance of over 200 feet. It varies in width from a few inches to 3 feet and occupies part of a poorly defined shear zone, 1 to 5 feet wide. Pyrite is abundant in quartz and sheared granite and chalcopyrite is conspicuous only in quartz. Free gold is prominent in many parts of the small vein. Assay values are said to be high for a short distance on the surface. A few tons of rich ore were taken from a shallow shaft which was sunk on the vein.

LONG AND BERESFORD LAKES AREA

Few claims have been staked and no notable discoveries have been made in an area east and southeast of the discoveries around Gold lake, and west of Long and Halfway lakes. A few finds have been made at intervals along Wanipigow river as far east as Wallace lake, but so far, none of these have created much interest. The most easterly area in the district, however, one lying north of Manigotagan river between Halfway, Long and Beresford (Bulldog) lakes, has a large number of gold deposits, some of which are of outstanding interest.

The most westerly portion of this area is occupied by granite, granodiorite and related rocks. The most important deposits here are in shear zones in granodiorite on the Eldorado group of claims. There are two prominent shears on the Eldorados besides some of lesser importance. Fairly continuous bodies of quartz appear in narrow shear zones and are traced for great distances. The most prominent shear zone, carrying quartz most of the distance, is traced for 1,800 feet almost continuously. The zone varies in width from 3 to 10 feet and quartz typically makes up about one-fourth of this width. Quartz is traced in another parallel zone which shows less shearing, for a distance of about 1,000 feet. Free gold is easily seen in most outcrops of quartz and values are fairly uniformly distributed. Carbonate gangue minerals are commonly seen but are not abundant. Pyrite is prominent in both quartz and adjacent sheared and silicified rock. A little chalcopyrite occurs in quartz. Galena is of scanty occurrence. The main shear zone has been carefully developed on the surface and two shafts have been started on the property. Further sinking is contemplated. Values from careful channel sampling indicate a workable deposit, were power and transportation facilities to improve somewhat.



1. Sampling a Prospect—Beresford Lake.
2. Sampling a Prospect—Clearwater Lake—Rice Lake District.
3. Shear Zone—Rice Lake District.
4. Selkirk Gold Mines Plant—East of Wanipigow Lake—Rice Lake District.

The northwest end of the Eldorado shear is a little south of the southwest end of Halfway lake. Here there is a deep covering of drift. Some distance to the northwest appear some breaks carrying quartz, one of which might be a continuation of the main Eldorado shear. On the Nugget claim, also near Halfway lake, a fracture zone carrying mineralized quartz has been traced for over 600 feet into covered ground.

The following extracts are taken from Wright's (23) description of the deposits north of Long lake:

"Prospecting has been active in this area since the summer of 1916. The first prospect was opened by Mr. A. M. Stewart near the middle of the southeast side of the Dardanelles mineral claim. At this point a pit about 15 feet in depth was sunk along a fracture zone striking north 30 degrees west and dipping 40 degrees east. The country rock in the vicinity of this pit is trachyte and andesite lavas, but the mineralized zone is in the andesitic rock, of which the foot-wall is massive and the hanging-wall is fractured and schisted. There is little or no quartz in sight and the fracture does not extend over 200 feet along the strike. The contact of the lavas and granitic intrusives is about 800 feet directly south.

"About 1,000 feet to the west of this pit and on the Elora Fractional claim, Mr. Stewart in 1922 installed a two-stamp amalgamation mill, and produced several thousand dollars worth of gold bullion from a small but very rich deposit. This deposit was worked by open-cut methods, and a trench striking north 70 degrees west and about 100 feet long, 15 feet deep, and 2½ feet wide was dug. Considerable arsenopyrite was noted in pockets irregularly distributed through the quartz, and associated with this arsenopyrite were some very rich specimens with free gold."

Wright also describes some occurrences of gold-quartz on a number of claims in the vicinity of the Elora Fractional, namely: the Red Top, Valley Vein, Blenn, North Star, Gold Hill, Joffre and Growler, the last two of which will be mentioned in connection with recent developments on the Kitchener group. His description of other deposits south of these and closer to Long lake is quoted:

"In the vicinity of Walton's cabin, which is about 4,000 feet north of Walton's landing near the east end of Long lake, there are several small but very rich outcrops of gold-bearing quartz. The rock here is granite porphyry and granodiorite and represents the beginning of a tongue-like projection from the southeast corner of the large granitic mass that extends from Gold lake. All the deposits north of Long lake, with free gold, are

either a short distance within this intrusive mass or in the lavas less than one mile from this contact.

"On the north slope of the hill and about 300 feet southwest of Walton's cabin the granite porphyry rock is fractured and impregnated with quartz lenses carrying free gold. This zone has a width of 10 to 15 feet and is exposed 100 to 150 feet along the strike, which is north 70 degrees west. To the northwest along this strike and about 300 feet across a sand-covered depression is another shear striking in the same direction and with about 3 feet of quartz for 100 feet along the strike. Here the quartz is dark colored and carries pyrite, molybdenite and a little free gold. To the southeast of the cabin the granite porphyry is sheared and impregnated with quartz and a short distance farther to the east a very rich but small quartz lens was discovered in August, 1923. Very rich specimens can be collected from a number of these small quartz lenses."

In 1923 an attempt was made to mine and mill a small rich vein on the Onondaga claim which lies a short distance to the east of the deposits last mentioned. A shaft was sunk on a lens of quartz about 3 feet wide to a depth of 100 feet. Drifts were run for 200 feet. High assay returns were secured in many parts of the vein. A five-stamp mill was erected on the property.

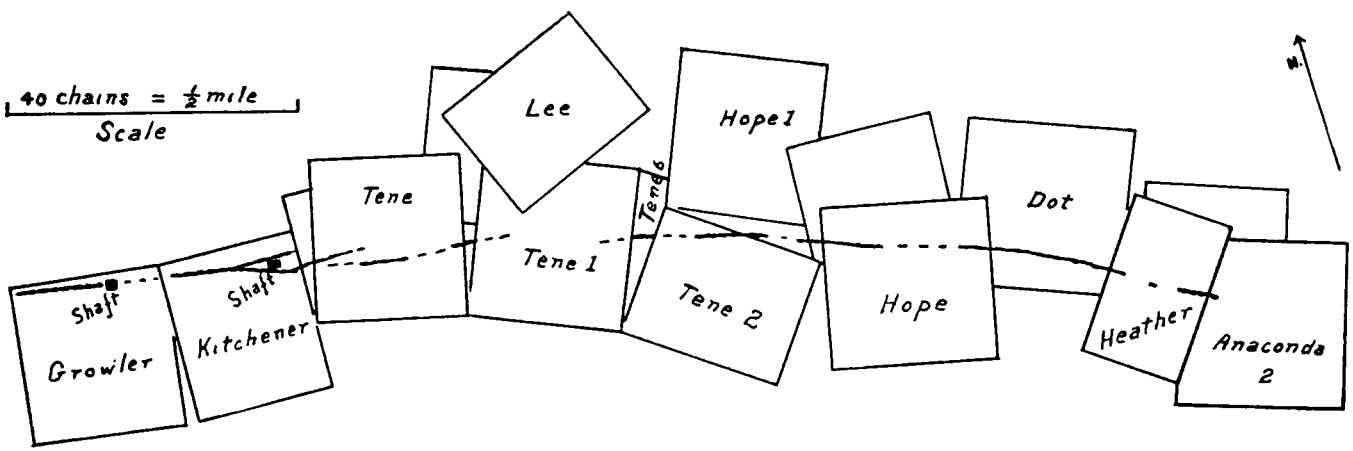
In 1926 a shallow shaft was sunk on the shear zone on the Mirage claim which lies about one mile east of Bidou lake. Quartz in small quantities is fairly persistent in a narrow shear that strikes about east and dips steeply to the north. Some beautiful specimens of crystallized gold were secured from the quartz. Pyrite and other sulphides are not prominent in the deposit but ankerite is conspicuous in both quartz and altered rock and accounts for the rusty-looking outcrop. Slickensides are a prominent feature in the quartz. Strong shear zones appear in the country north of Rice bay and near Stormy lake. An outstanding occurrence is a strong shear zone on the Maberly group of claims, a short distance east of Stormy lake. This wide zone makes a small angle with the strike of surrounding andesite schists, which is about southeast. There are numerous outcrops for a long distance along the strike, showing notable widths of quartz in veins, lenses and stringers, well mineralized by pyrite. Values are said to be encouraging over workable widths and lengths and development work has been arranged for.

Between Stormy and Beresford lakes gold occurrences have been known for several years. Wright (23) describes some of these on the Madeline, Gunner Fractional, Tineys and Edna claims. The most serious attempts at development were made on the Tiney group by the Deep Rock Gold Mines Company. Rich ore bodies of small size are known to occur on parts of the

foregoing claims, but no large workable ore-body has so far been exposed.

Probably the most important development work so far done in the Rice Lake district has been that carried on up to the present time by Central Manitoba Mines on the Kitchener and adjoining claims, about 3 miles northwest of Beresford (Bulldog) lake. In 1925 and 1926 extensive surface and underground work was done on a strong shear zone which has been traced for about 2 miles. The plan in Fig. 3 shows the outcrop and the positions of the claims along it. The strike is a little south of east and the dip is to the south. Much work has been expended in opening up the surface to expose the quartz of the shear zone in as many places as possible. Considerable diamond drilling was also done in the earlier stages of development. The major underground operations have so far, however, been confined to the Kitchener claim, where a strong and almost continuous outcrop of ore was traced for a length of over 900 feet. A vertical three-compartment shaft was sunk at a point about 300 or 400 feet west of the east boundary of the Kitchener. Cross-cuts were made from the shaft to the vein at depths of 125 and 375 feet. Drifts follow the vein from the 125-foot cross-cut, 600 feet west and 240 feet east. A drift of 1,300 feet long (September, 1926) runs west on the 375-foot level. A raise was put in from this drift at a point about 600 feet from the cross-cut, and a winze followed the vein down 90 feet. More work was done on the 375-foot level in drifting along a branch vein from west to east, a distance of over 100 feet. The cross-cut on the same level was extended to intercept this branch. Drifting was carried on for over 100 feet from this intersection. A little drifting was also done eastward from the cross-cut on the main vein. There has been some underground development on other claims. A two-compartment prospecting shaft was sunk on the Growler claim to a depth of 120 feet. Other shafts have been started on the Tene 6 and the Hope. Seven diamond drill cores were secured on the Kitchener claim, one on the Tene and six on the Growler. Much surface work has been done on many of the group in stripping, trenching and sinking shallow pits. The properties are well equipped with steam and gasoline power plants, compressors, hoists, assay office and camp buildings.

The ore on the Kitchener group consists mainly of quartz mineralized with pyrite, chalcopyrite and extremely fine gold. Some mineralized schist in the shear zone should also be included. Gold is not apparent in hand specimens and can only be seen after very careful grinding and panning. The shear zone lies in a series of schists, mostly andesites and more acid volcanics. Some associated felsites and porphyrices that are fairly



Ground Plan of Kitchener Group of Claims in the Beresford (Bulldog) Lake Area. Showing Outcrops of Gold Deposit.

massive may not belong to the volcanic series, but may be facies from the local batholiths of granite and similar rocks. As in many parts of the Rice Lake district, the best gold values seem to come from those parts of the ore that contain chalcopyrite as a prominent constituent.

Sampling of the outcrop on the Kitchener claim establishes a stoping width of $13 ore for a length of 900 feet. Underground work beneath this outcrop indicates a continuous ore-body of a little lower grade but greater length. On the Tene 6 claim there is an outcrop 190 feet long exposed by stripping, which shows values between $15 and $25 per ton for widths averaging over 16 feet. Values and widths in the shaft on this outcrop are equally good. Work done on some of the more easterly claims of the group has demonstrated local high values. Sufficient work has been done to indicate the probable existence of a large workable deposit of gold ore and to justify the erection of a mill. A great deal of underground work remains to be done to permit a remote estimate of the value of the property. Developments up to the end of 1926 have been very encouraging and plans have already been made for the installation of a mill. Notwithstanding the remoteness of the property, involving great transportation difficulties, development has been rapid and as economical as circumstances permit, due to very able management. A contract has been made with the Manitoba Power Company for a supply of electrical power from Great Falls on the Winnipeg river. This power supply will no doubt facilitate the development of the property and will make possible a more economical working of this and other deposits of the district.

In 1925 considerable underground work was done on the Oro Grande-Solo group on Beresford (Bulldog) lake by the Anglo-Canadian company. A quartz vein outcrops on these claims a few hundred feet west of the north end of the lake. A plant, including two boilers, an air compressor, hoist and assay office were installed on the Solo claim. A shaft was sunk to a depth of about 140 feet. At the 125-foot level a cross-cut was run west to cross the vein, along which drifts were run, one 60 feet to the south on the Solo claim and another 125 feet north into the Oro Grande. The vein was traced for a distance of about 500 feet on the surface. The cross-cut established its continuity to a point underground, 400 feet farther south than was known from the surface outcrops on the Oro Grande. The surface above the cross-cut and to the south of it is deeply covered by drift. Diamond-drilling established the presence of the vein 200 feet farther south than the end of the 60-foot drift. A 50-foot prospecting shaft was sunk on the Oro Grande at a point 400 feet north of the shaft. Additional work was done in stripping the outcrop and sinking test pits.

Where exposed or developed the Oro Grande-Solo vein shows a width varying from a few inches up to 6 feet. Ore averaging over $13 a ton is said to occur in the vein for a length of at least 1,000 feet. In most of this distance it is probably of workable width. Work was suspended on the property late in 1926 and the entire plant was removed for use on the Kitchener group. The deposit is believed to be one of the small prospective producers of the district.

OUTLYING GOLD DISCOVERIES

Development work on the Kitchener and Oro Grande-Solo properties in 1925 stimulated prospecting in the eastern part of the Rice Lake district and in the summer of that year many claims were staked in the country south and north of Beresford (Bulldog) lake. Perhaps the outstanding discovery was made for the Mining Corporation of Canada when the Cryderman property was located about 4 miles northwest of the north end of Partridge (Moore) lake. Free gold was first found on a small vein. This led to more intensive surface prospecting in the vicinity and a large outcrop of quartz was located in a wide shear zone. This large outcrop, striking about northwest, has been traced for 1,500 feet in widths of quartz varying from a few inches to 20 or 25 feet. The shear seems to persist for at least 3,600 feet. The dip is about 60 degrees to the southwest. The discovery vein is to the northeast of the main vein. The east end of it strikes nearly east but the western part approaches the main vein and is almost parallel to it. The outcrop is traced about 600 or 700 feet. The veins are in andesite and other volcanic schists. Chalcopyrite and pyrite with a little pyrrhotite are found in the quartz of both veins. Showings of free gold are common on the outcrops of both veins and tellurides have been recognized in small quantity. Carbonate gangue minerals are not abundant though conspicuous in places. The property is well equipped for preliminary development work, with steam boilers, compressor, hoist, electric generator, sawmill, assay office and camps. A shaft has been sunk to a depth of 260 feet. On the 150-foot level, a cross-cut 221 feet long crosses the vein and 435 feet of drifting was done On the 250-foot level there is a cross-cut of 109 feet and 131 feet of drifts. The showings underground are not as promising as the surface would lead one to expect. More underground work is needed and arrangements are said to have been made for deeper exploration with diamond drills.

In the summer of 1926 the Victoria Syndicate carried out surface investigations on a number of claims held by them in the vicinity of the Cryderman deposits. It is understood that

sampling results from their deposits did not warrant further operations.

Discoveries were also made in 1925 and 1926 in an area to the southeast of Beresford lake, between Garner and Gem lakes. Among these is one made by Walton on the former lake, near the portage into Gem lake. On the latter lake, not far from the same portage, Irving located another shear zone. Both of these discoveries look promising enough on the surface to warrant sampling. They are of particular interest in establishing an extension of the gold-bearing area.

Another extension of the metalliferous district was established in 1926. Several gold-bearing outcrops were located near Slate lake to the south. The most promising of these are east of Slate lake and a short distance south of the south branch of Manigotagan river and west of the Ontario boundary. Too little work has been done to demonstrate their importance.

Transportation

The Rice Lake district is about 100 miles in a northeast direction from Winnipeg. The nearest railroad points, at Pine Falls, Great Falls and Pointe du Bois, all on Winnipeg river, are about 40 or 50 miles from the centre of the gold-bearing area.

Supplies were formerly taken in during the summer months by canoes up Wanipigow and Manigotagan rivers. This method is still used to some extent and during the past two summers there has been considerable canoe-freighting on Oiseau river. Summer transportation has been helped greatly by a summer road built by the Manitoba Government from a point on Wanipigow river above Wanipigow lake, to Caribou (Quesnel) lake, passing between Rice and Little (Red) Rice lakes. In using this route for summer freighting, goods cross lake Winnipeg up to the first portage on Wanipigow river, thence by wagon over a portage and by canoe to Government Landing. From this point they are carried by wagon to Caribou lake. Canoes are again required for traffic bound farther east. Central Manitoba Mines constructed two summer roads to the Kitchener group of claims, one from Beresford lake and another from Long lake, each 3 or 4 miles long. The Mining Corporation joined the Cryderman to these roads with another somewhat longer wagon trail.

As much as possible of the heavy freight used for major operations has always been taken into the district in the winter time on sleighs. Most of the freight during the earlier years of development and that destined for the western part of the district in later years, was taken across lake Winnipeg to Manigotagan river and thence by winter road into the mining camps. For the later extensive developments of the eastern area, most of the

freight has been taken over a winter road running northeast from Great Falls on Winnipeg river.

The Canadian Pacific Railway Company surveyed a prospective railway line during the past summer (1926) from Great Falls to Long lake, but so far no definite steps have been taken towards construction. An electrical power line, to be built shortly from Great Falls to the Kitchener group near Beresford lake, will indirectly solve some of the transportation difficulties which the district has suffered. Until a railway or some other satisfactory overland transport system is developed, the district will be seriously handicapped through being cut off from the outside world during the spring break-up and the fall freeze-up periods. It is expected that better transportation facilities will be gradually forced by developments in the district.

Summary and Economic Aspect

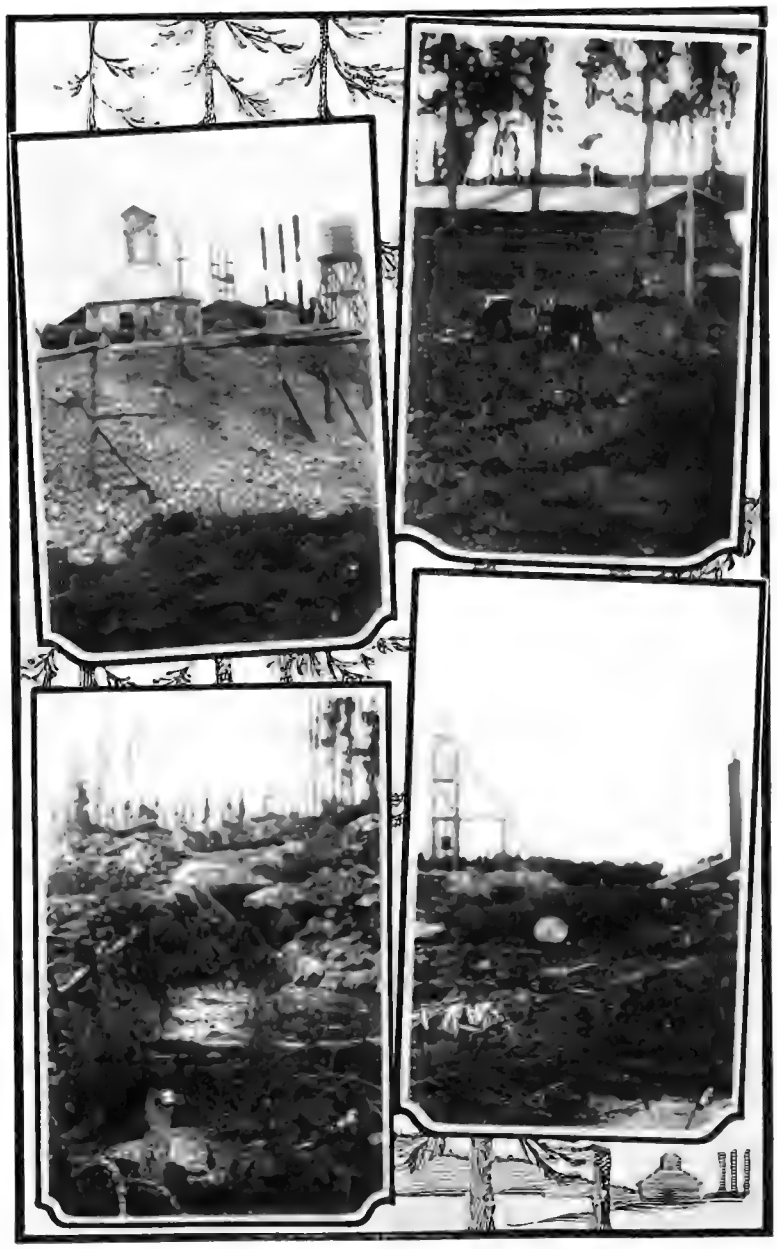
In a bulletin (9) issued in 1920 by the Manitoba Government, there is the following summary of the economic aspect of the Rice Lake district, as it appeared then:

"In the history of mining development in Manitoba, the Rice Lake district wears the aspect of an old camp. It has received attention for a period of only nine or ten years, four of which were the years of the war. This is a comparatively brief time for the development stage of a mining district. Many mining camps have reached the producing stage in a shorter time, but many others, and some of the greatest, required many more years. To some the district appears as one which has gone through all its stages and which has not been proved. This attitude is decidedly unfair, as the district is still, relatively speaking, in an early prospective stage. To one passing through and impartially examining the whole district, it is apparent that there is a huge area of attractive prospecting ground, containing some possibilities in the deposits already located in its smaller areas and greater possibilities in its unprospected larger areas."

"In forming an estimate of the possibilities the district has of becoming a gold producer, the following statements will be worth considering:

"The area showing gold is a large one. It is growing year by year through the finding of new outlying fields. New finds are being made constantly in older portions of the district. Hundreds of different deposits yield attractive samples of free gold.

"Though considerable work has been done on several claims, no property has yet the rank of a producing mine. In this connection it should be stated that the best surface showings are not in all cases the ones that have received most attention.



Upper left—Kitchener Mine Shaft Head and Ore Dump—Beresford Lake Area.
Upper right—Cabin on the Oro Grande showing Beresford Lake in Background.
Lower left—Trench on the Oro Grande—Beresford Lake Area.
Lower right—Shaft Head on the Cryderman Claims—Moore Lake Area.

"Among the factors that have prevented development work and possibly production, one that should receive considerable weight is the lack of transportation facilities.

"It is unfortunate that a great part of the district has been held back from the attention of prospectors, owing to the staking of so many claims for 'location.' But there is a great deal of open country left and in most cases unprospected claims could be examined by arranging terms with the holders.

"In conclusion it might be stated that the general impression left after an examination of the district is that it will be surprising if in future years the Rice Lake district is found to have no workable gold deposits. The duration of these years will be lessened if a spirit of co-operation is fostered and active steps are taken to check exaggerated stories and illegitimate promotions, both of which have done an infinite amount of harm."

In comparing the outlook for mining with that of six years ago, it may be said to have grown even more hopeful. Some strong mining companies with efficient staffs of engineers have at last come to take an interest in its prospects. A few promising deposits are being developed. Reports from the district have become more reliable and unfortunate stock-selling promotions have become a thing of the past. There are legitimate fields for local capital, in the financing of prospecting parties, in the formation of development syndicates and in investing in properties being developed by strong mining companies. The district is passing now from its leanest years to the producing stage.

OISEAU RIVER DISTRICT

The Oiseau river district as herein described includes the country tributary to the lower stretch of Oiseau river, that lying between Oiseau lake and Lac du Bonnet. For convenience in describing certain mineral deposits of rather wide occurrence, the district name includes country to the south in the vicinity of Winnipeg river as well as some to the northwest near Maskwa river. The country has been fully described by Wright (24) who has also made an excellent geologic map of the area. The writer is indebted to these publications for much of the information in the following pages.

Location and Means of Access

The district lies about 75 miles northeast of Winnipeg. Oiseau river is conveniently reached by boat from Lac du Bonnet. Canoes are used above the first rapid. The Winnipeg river area is served by a railway to Pointe du Bois. Maskwa river may be ascended with some difficulty by canoes from the mouth on Winnipeg river a few miles below Great Falls. There are two or three canoe routes between Winnipeg and Oiseau rivers and the country to the north of the latter river has a few foot and wagon trails.

History of Prospecting

A few old stakes and pits on sulphide deposits on and south of Oiseau river indicate that some interest was taken in the mineral possibilities of the district perhaps 20 or 30 years ago. In the winter of 1917-1918 claims carrying copper and nickel deposits were staked near Maskwa river. Many more claims were staked in this vicinity during 1918 and 1919. In 1920 discoveries of similar sulphide ores were found a short distance north of Oiseau river. In 1923 and 1924 considerable surface and underground work and diamond drilling was done on these copper-nickel prospects. An important body of lithium-bearing pagmatite was located close to Winnipeg river, a few miles above Pointe du Bois, during the summer of 1924 and since then several similar deposits have been located both south and north of Oiseau river. Claims have also been staked on a few other types of deposits.

Surface Features

The general aspect of the country is much the same as that of the Rice Lake district. Outcrops of bedrock are larger and more numerous upstream and near divides between drainage

areas. The lower stretches of Oiseau and Maskwa rivers pass through country deeply covered by lake beds and drift deposits and with comparatively few rock outcrops. The country is generally wooded and there are some considerable areas of excellent pulpwood.

Geological Features

The consolidated rocks of the district all belong to Precambrian formations. A prominent belt of schists of sedimentary and volcanic origin lies along Oiseau river on both sides. It is about 4 to 6 miles wide and strikes about east and west. To the east the belt is entirely south of Oiseau lake. Schists occur as narrow bands in other areas. Most of the remainder of the country is occupied by plutonic intrusives. These latter rocks are massive in places and gneissic in other parts. The bulk of them are granites and quartz-diorites, though to the north of Oiseau river there are large outcrops of basic intrusives, chiefly gabbro. The reader is referred to Wright's (24) report for particulars regarding the different rock formations and their age and structural relations

Mineral Deposits (General)

The prominent types of mineral deposits in Oiseau river district are nickel and copper-bearing sulphide bodies associated with areas of gabbro and peridotite, and lithium-bearing pegmatites which probably are associated with intrusions of the youngest granite magmas of the region. The copper-nickel deposits are in two areas, one a little north of Oiseau river and another near Maskwa river. Lithium pegmatites occur near Winnipeg river and 12 miles north of Oiseau river, as well as in several places south of the latter, so that the occurrences are fairly widespread.

COPPER-NICKEL DEPOSITS

Wright (24) recognizes three groups of sulphide deposits on the basis of mineral composition: (1) deposits of pyrrhotite, pentlandite and chalcopyrite, in which nickel is an important metal; (2) deposits of chalmersite, chalcopyrite, pyrrhotite and pyrite in which copper is the important metal; and (3) deposits of chalcopyrite with minor amounts of sphalerite and galena. The fact that all these deposits are in areas where gabbro outcrops, many of them being near contacts of this rock, suggests a genetic relation with it. Moreover, there is a world-wide

association of ores of these types with gabbro rocks. The more prominent deposits of the belt north of Oiseau river will be described as they occur from west to east along the belt.

On the Wento claim, sulphides are disseminated in sheared and crushed zones in rather basic volcanic schists close to gabbro contacts. Massive and disseminated sulphides occur in an outcrop exposed in a large area. The sulphides vary greatly in quantity and kind from place to place in the mineralized rock. They consist mainly of chalcopyrite, chalmersite, chalcopyrite and pyrite. Magnetite is prominent in both rock and ore. The drift covering is fairly deep over most of the area, so that surface development is difficult. A mineralized outcrop, varying in width from a few feet to nearly 100 feet, has been exposed by a number of trenches for a distance of 300 feet. A little underground work was also done. Values are very unevenly distributed. Some notable areas on the outcrop have between 5% and 15% of copper and a few ounces to the ton in silver. Other areas carry less than 2%, but by mixing high and low grade ore it is possible that a considerable tonnage of commercial ore could be secured from depth in the deposit. The outcrop has been oxidized and deep trenching is necessary to expose the primary ore.

The workings on the Cup Anderson claim are a little more than a half-mile northeast of the Wento outcrop. The deposit was developed between 1923 and 1925. Surface development was found to be difficult owing to a thick covering of drift, so that diamond-drilling was resorted to as the most feasible way of investigating the deposit. Owing to the irregular distribution of ore-minerals, even this method is not highly satisfactory. The sulphides are in much altered volcanics, some of which are garnetiferous. Peridotite outcrops to the east and gabbro a few hundred feet to the south of the mineral deposit. The exposed sulphide body seems to be roughly parallel to the enclosing schists which strike a little north of west. About 200 feet of orebody has been exposed along the strike. Diamond drilling showed that it extended east about the same distance underground. The average width over the 400 feet is probably around 30 or 40 feet. The width varies greatly from place to place and so do values. Chalcopyrite in stringers and bunches in the schists is the prominent ore-mineral. Pyrite and pyrrhotite are nowhere conspicuous and are typically not in evidence. Sampling of outcrop and trenches indicates a considerable body of copper ore that could be worked under proper conditions. As in the Wento deposit, there are also small values in silver.

The Wento and Cup Anderson deposits were developed by the Wad syndicate working through the Manitoba Copper Company. Operations were carried on in 1921 on the Devlin and

Chance claims to the east, by the Devlin Mining and Development Company. The Devlin claim is about a mile east of the Cup Anderson, and the Chance claim is a half-mile still further east.

On the western part of the Devlin claim there is a large sulphide zone which passes westward about 300 feet into the Martin claim. The zone is in andesite schist close to a granite contact which strikes a little south of west. The mineralized zone has been traced about 800 feet on both claims, in a width varying from 2 or 3 feet to 70 or 80 feet. Massive pyrrhotite outcrops in lenses which have maximum widths of about 3 feet and lengths of close to 100 feet. Other parts of the zone contain schists which have been notably mineralized by sulphides in bunches, grains and stringers. The ore-minerals are pyrrhotite in large quantities and chalcopyrite in small scattered amounts. Pentlandite is said to be absent or rare. Results of channel sampling show an average of about 1% copper and ½% nickel in the richer parts across the zone. Three other sulphide-bearing zones on the eastern part of the Devlin claim have had some work done on them. The deposits were trenched and two shallow shafts were sunk on two of them. The sulphides are mainly pyrrhotite and chalcopyrite. Locally a commercial grade of copper ore is obtained across narrow widths.

East of the last-mentioned deposits the country is deeply covered by drift, but about a half-mile to the east another sulphide deposit has been exposed on the Chance claim. Like the Devlin deposits, the sulphide zone on the Chance is in basic schist close to an east-west granite contact on the north. The zone has been traced for a considerable distance by means of surface work, but the chief development work consisted mainly of the sinking of two shafts, each about 25 feet deep. The shafts are 150 feet apart and lie towards the western portion of the sulphide zone. The sulphides, consisting of pyrrhotite, pentlandite and chalmersite, are in small bunches or fine grains disseminated through the rock and intermixed commonly with large crystals and grains of hornblende. Samples from the shafts give an average value of a little less than 2% of nickel and less than ¼% of copper.

Wright (24) describes the Beaver-Diabase group lying west of and close to the Wento claim, as containing several exposures of sulphide bodies. One of these shows a considerable content of lead, zinc and silver, besides smaller values in copper and gold. The same writer describes the Osis prospects farther east near Oiseau lake and groups of claims west of the Wento, known by the following names: Rex, Hunter, Regal, National, Ross-Allison, Anson Lake, Muskrat and Gilmore-Hall. All of these groups of claims have signs of sulphide deposits very similar to those

already described. A fairly continuous copper and nickel-bearing belt, stretching east from near Lac du Bonnet to Oiseau lake, is indicated by these numerous occurrences. It is unfortunate that most of the country is so deeply drift-covered that prospecting is made very difficult.

In the vicinity of Maskwa river, there are several deposits distributed over a considerable area of country, which bear a close resemblance to those north of Oiseau river. The sulphide bodies near Maskwa river are typically near contacts of gabbro and basic schist, and most of the mineralization appears to be in the schist. The sulphides, chalcopyrite and pyrrhotite, occur in nearly all deposits of the area. Pyrrhotite is abundant in most deposits and chalcopyrite is only locally prominent. These minerals are disseminated in grains, veinlets and small irregular bodies of mashed and replaced rocks. Massive sulphide bodies are very small or wanting. Assays of various materials from the ore-bodies vary between ½% and 3½% for copper and ¼% and 1½% for nickel, with traces of the platinum group of metals. Since the later and more promising discoveries of similar ore near Oiseau river were made, compartively little attention has been paid to the Maskwa area. The largest outcrops showing sulphides occur on the Mayville and Hititrite claims. Considerable surface work, mostly trenching, was done on both claims, but particularly on the former. On it, also, 2,000 feet of diamond-drilling was done in 1923 for the Devlin Mining and Development Company. The existence of a considerable body of low-grade ore was proved by this work. The reader is referred to McCann's report (14) for a detailed description of the Maskwa river area and deposits.

LITHIUM DEPOSITS

Lepidolite, a lithium-bearing mica, was found several years ago in southeastern Manitoba, close to Star lake and near the Ontario boundary. In 1924 a large deposit containing this and other lithium minerals was located close to Winnipeg river, about 10 miles above Pointe du Bois. Since then other bodies of pegmatite carrying lithium have been located in the Winnipeg river area, also south of Oiseau river and again 10 or 12 miles north of the latter river near Cat lake. These widely scattered deposits prove the existence of a large area with lithium prospects, and the small amount of prospecting required to find these, suggests a probability that other bodies will be located. The occurrences will be mentioned from north to south.

The most northerly deposit so far located is less than a half-mile north of Cat lake. This lake is about 10 miles north of Oiseau river and will probably be found to lie near the middle of

township 19, range 15. A well exposed outcrop of a large pegmatite dyke stretches east-west across the Irgan claim and for some distance on an adjoining claim to the west. The dip is about 65 degrees south. The dike is exposed for a distance of 1,200 to 1,500 feet. It narrows and branches to the west and passes under muskeg to the east. In a length of at least 1,000 feet on the Irgan claim, the dike has widths varying between 10 or 15 and 60 or 70 feet. The country rock is basic schist with laminations parallel to the dike. Soda and potash feldspars, quartz, spodumene and pale yellowish-green mica form the bulk of the deposit. A single shallow excavation was made in average material on the south side of the outcrop. This pit disclosed, besides the minerals already listed, small amounts of beryl, manganapatite, garnet, native bismuth and traces of a heavy sub-metallic mineral, probably tatalite. Typically, in the widest outcrops, it was estimated that the hanging-wall half of the deposit showed spodumene as a prominent constituent. Of this, widths of 5 to 20 feet appear to contain dike-stuff, one-half of which is spodumene. The outcrop of the dike is smooth and retains a glacial polish in most places. Its attitude is such that the surface is well drained and little or no weathering has occurred since Pleistocene time. Spodumene, a mineral that weathers easily, is typically as fresh-looking as feldspar in the outcrop. Moreover, the dike is very massive and it is next to impossible to penetrate it without drilling and blasting. The outcrop suggests a great concentration of lithium and the deposit will merit close examination when a market is available for the material it contains.

About a half-mile south of Cat lake, near a small creek that flows from the south into the lake, there is an outcrop of another large lithium-bearing pegmatite dike. The country-rock here is chiefly a gray quartz-diorite. Locally it contains narrow to wide bands of andesite schist, which appear to be roof-pendants. The pegmatite dike outcrops on the vertical side of a cliff facing the creek to the east. The hanging-wall dips at low angles, back into the hill and also to the north and south from a central anticlinal arch. The foot-wall does not appear any place, so that the thickness of the dike or body is nowhere indicated. In the widest exposure the thickness is at least 15 feet. The pegmatite consists mainly of feldspar, quartz, spodumene and mica. Spodumene is the only prominent lithium-bearing mineral so far found in the deposit. Locally, manganapatite is conspicuous in deep blue grains and crystals of small size. Small grains and plates of a submetallic heavy mineral, probably tantalite, also occur. Spodumene occurs in tabular crystals or plates, varying in length from less than an inch to rarely a foot. The plates are mixed with and separated from each other by quartz, the two minerals being commonly in about equal parts in the mixture. It was

estimated in a rough way that about one ton of a mixture of equal parts of spodumene and quartz could be hand-picked from each four or five tons of rock broken from the face. Locally, and particularly towards the southern end of the outcrop, probably a ton of the mixture could be picked up from two or three tons of broken dike-stuff. The hanging-wall of the dike is well exposed for at least 100 feet. Signs of what appears to be the same body are picked up within a few hundred feet north. To the south, the dip makes the outcrop inaccessible. This deposit, like the one north of the lake, will be worthy of some investigation should a market arrive for the spodumene-quartz mixture. It is also possible that development work will demonstrate the presence of richer concentrations of spodumene and other lithium minerals. Phosphorous is present in both dikes in apatite, suggesting that amblygonite might appear in some places.

A few outcrops of lithium-bearing pegmatite have been located a short distance south of the east end of Cat lake. They suggest bodies of smaller size than those just described. The deposits appear to be very irregular in form, and widths vary greatly and abruptly along the strike. Spodumene is the only lithium-bearing mineral so far found in them and it is not prominent. Large to small crystals of colorless or milky beryl are conspicuous in one of the dikes.

Other discoveries of lithium-bearing pegmatite have been made to the south of Oiseau river, close to the east end of Bernic lake. A large number of outcrops appear in a small locality. Some of these are traced for a few hundred feet and many of them are probably joined by continuous bodies of considerable length, whose outcrops are hidden for the greater part by drift. The larger outcrops belong to dikes or bodies which are flat-lying or have low angles of dip. Other smaller outcrops vary in attitude and some are irregular in form and do not appear to be very continuous. It is possible though, that all of these outcrops are more or less connected at depth. Locally, lithium-bearing minerals, chiefly spodumene and amblygonite (montebrasite variety) are prominent. Likewise, colorless beryl, black tourmaline and apatite. A prominence in a few outcrops of purpurite and heterosite, secondary manganese and iron phosphates, suggests the presence of triphilite and lithiophilite in the primary dike-stuff. The deposits are of great mineralogical interest and offer possibilities as sources of lithium minerals and beryl.

The first discovery of a lithium deposit in Manitoba, that seemed to offer commercial possibilities, was made in 1924, when lepidolite, a lithia mica, was discovered in a large body of pegmatite, a little south of Winnipeg river, about 10 miles above Pointe du Bois. The pegmatite occurs in andesite schist not far

from areas of granitic rocks. A narrow band of andesite continues to the east for several miles. This occurrence has been described in considerable detail by Wright (24) and much of the following information has been taken from his report.

The pegmatite is exposed for 125 feet in an east-west direction and across an average width of 80 feet. Pits dug in adjacent muskeg and drift to the south and west indicate a considerably larger outcrop. Quoting Wright: "The pegmatite varies considerably in texture from the edge to the centre of the mass, and there is a zonal arrangement of the different minerals. The outer part, with a maximum width of 3 feet, is a pink or salmon-colored, medium-grained, alkali granite. This evenly granular type gradually passes, inwardly, into a pink to flesh-colored, uneven-grained rock, consisting of quartz, microline and minor amounts of dark-colored mica. The quartz is irregularly distributed in small, white or slightly smoky, opaque masses. No graphic intergrowths of quartz or feldspar were seen. Microcline is by far the most abundant mineral and a few masses of it are 2 or 3 feet across . . . . No lithium-bearing minerals were noted in either of the outer zones . . . . However, within a varying distance, of from 20 to 50 feet from the walls, the unevenly granular rock type irregularly grades into a central body of white pegmatite, consisting principally of white alkali feldspar, spodumene, and montebrasite (identified by Mr. E. Poitevin), but with two lenses of massive lepidolite near the south side. The spodumene and montebrasite occur as pockets within the feldspar mass and it is estimated that they form about one-half of the rock. A few small pockets and veinlets of lepidolite occur with these minerals."

A sample of compact crystalline lepidolite is reported to have analysed 3.87 per cent. lithia, and one of the spodumene-bearing rock from which gangue had been removed, 4.76 per cent. lithia.

Camps have been erected on Winnipeg river and a pole-tram and winter road, each 3 miles long, have been built into the property. Considerable surface work has been done on the deposit by the Silver Leaf Mining Syndicate and small shipments have been sent to England and other places for test treatment.

Other lithium-bearing pegmatites are known to occur at other points near Winnipeg river. Altogether, the prospects between this area at the south and the Cat lake area to the north, offer considerable possibilities for a production of lithium minerals as well as of others, such as beryl, which occur in the same pegmatite bodies.

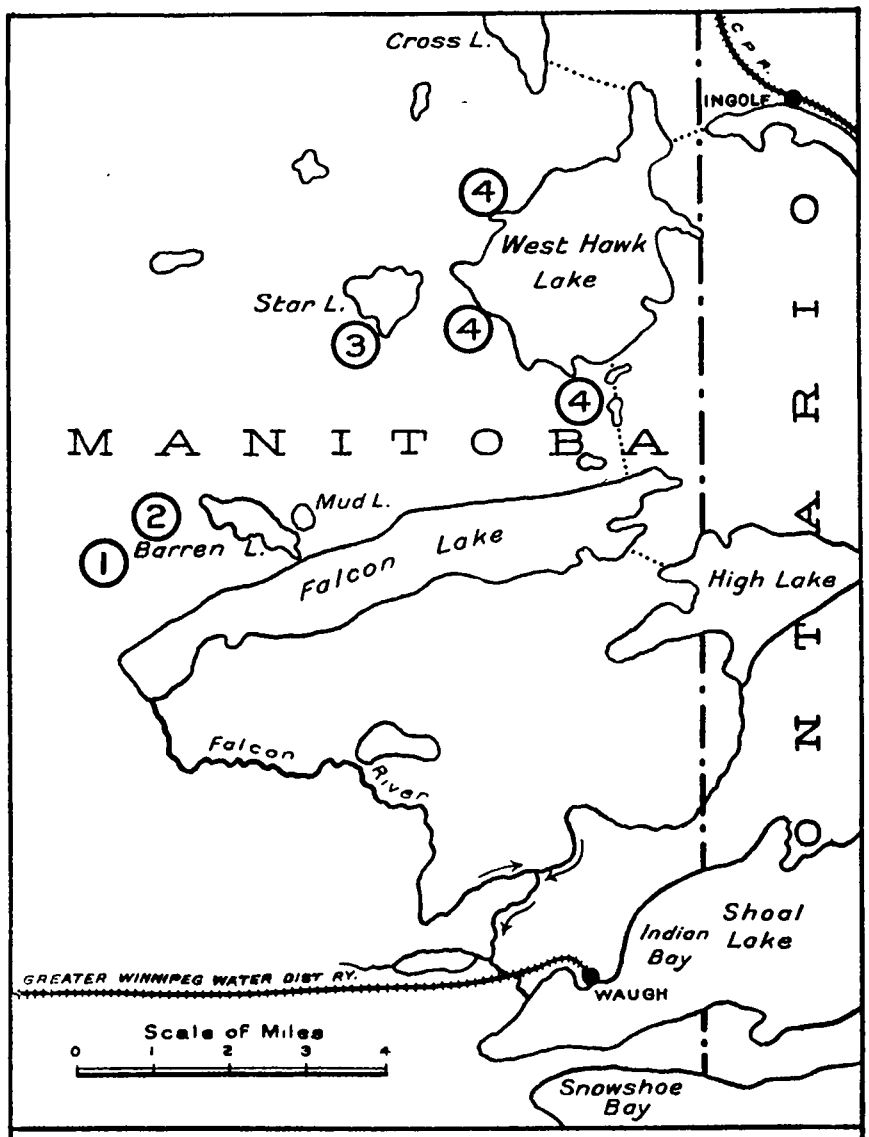
OTHER MINERAL OCCURRENCES

Bands of schist mineralized by massive and disseminated sulphides occur at a number of places south of Oiseau river. One of these bands occurs about two-thirds of a mile south of the west end of Oiseau lake. It is traced about 300 feet, with a width of about 5 feet heavily mineralized with pyrite. In an area farther west near the east end of Shatford lake, other bands occur containing pyrite, pyrrhotite, and in one instance, at least, massive arsenopyrite up to 2 feet in width.

Gold has been found in a number of prospects to the north of Oiseau river. About 10 or 12 miles north of the river, near Little Bear lake, two small veins have yielded good values in gold across narrow widths in the few exposed portions. Other occurrences are reported from points farther west.

Tin in very small quantity has been found in a few places. The most notable occurrence is that of cassiterite crystals in a narrow pegmatite dike that cuts a small rock-island on Shatford lake. Only enough of the pegmatite could be reached to provide a few very good samples of cassiterite.

Wright (24) mentions the occurrence of garnetiferous rocks along Winnipeg river in sections 21 and 28, range 16, township 16. Garnet forms as much as three-quarters of the rock in parts of some bands that have widths as great as 6 feet. It is a possible source of abrasive material. Traces of other economic minerals have been observed in the district, but so far none other than those mentioned appears to be of interest.



SKETCH MAP OF BOUNDARY DISTRICT

LEGEND

(1) *Molybdenite Deposits*
(2) *Tungsten Deposits*
(3) *Gold Deposits*
(4) *Sulphide Deposits*

BOUNDARY DISTRICT

The Boundary district includes that part of southeastern Manitoba which lies close to the Ontario boundary between the Canadian Pacific and the Greater Winnipeg Water District railways. It embraces West Hawk lake, Falcon lake and Star lake areas, and may be regarded as an extension to the west of Lake of the Woods mineral area of Ontario.

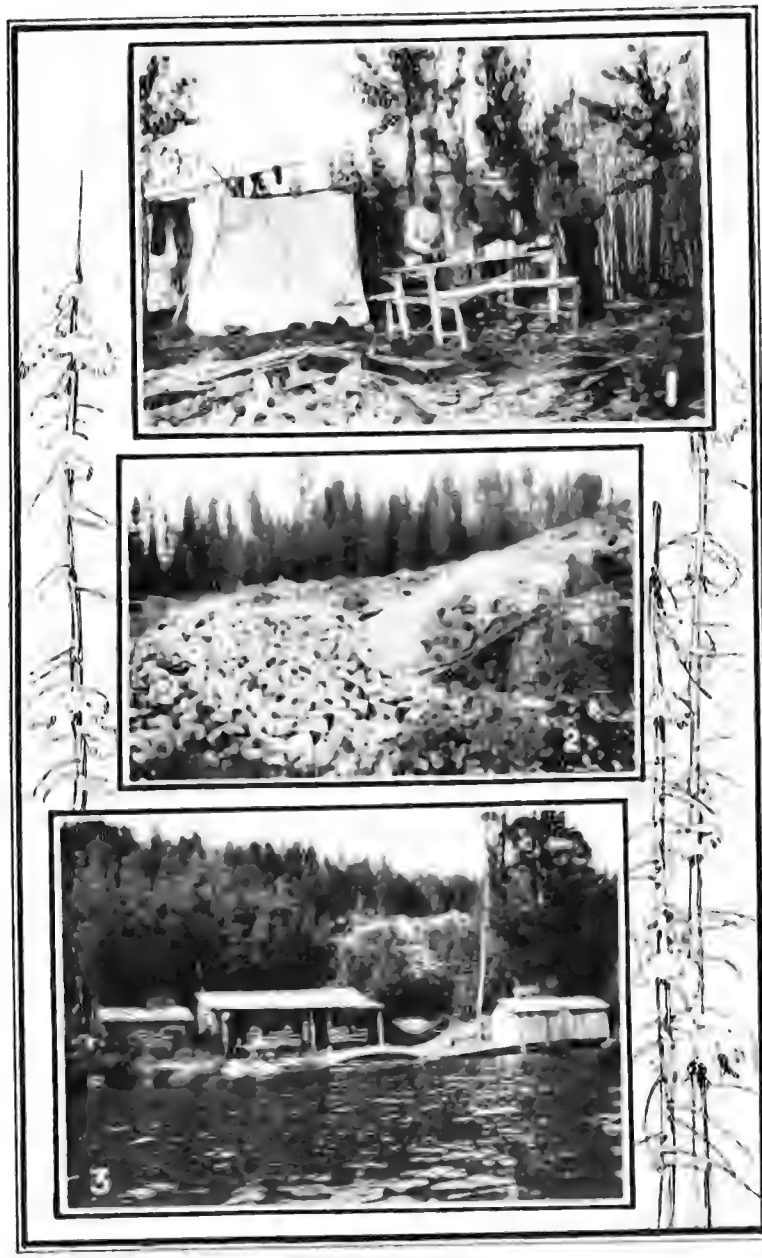
The district received some attention from gold prospectors during the Lake of the Woods gold-mining boom in the nineties. There are several patented claims dating from this time. Mineral deposits of many kinds have been found, but up to the present none have attained commercial importance. The earlier prospecting was entirely for gold and several occurrences were located. Later attention was directed to large mineralized zones of schist, of which there are many near West Hawk and Star lakes. These contain massive and disseminated iron sulphides with traces of several other metals. Still later some interest was taken in molybdenum and tungsten-bearing deposits.

The district is comparatively easily accessible. There are good canoe routes and trails leading to the more prominent mineral occurrences The general aspect of the country is very similar to that of Lake of the Woods and other neighboring Precambrian areas. The several lakes within the area have beautiful shorelines and islands. The beauties of the district and its easy accessibility are tempting more and more people to use it as a summer resort.

Geology

The rock formations of the Boundary district are very similar to those of the Lake of the Woods country lying to the east, the geology of which has been described by Lawson (11) and Parsons (16). Schists and slate-like rocks, derived chiefly from basic volcanics, but also to some extent from other volcanics and sediments, have been invaded by granite magmas with a production of great masses and tongues of granite and associated porphyries. The schists occur in all forms from small bodies with lens-like or dike-like outlines to fairly continuous bands up to 5 or 6 miles in width. The strike of the laminations in schists, as well as of the bands themselves, varies typically between northeast and east. The dip varies but the schistose structure is generally close to vertical in attitude.

The most prominent schist member is a hornblende variety which was largely derived from an ellipsoidal basalt and to a lesser extent from basic volcanic agglomerate. Banded sediments, garnetiferous sericite schists, graphitic slates and acid



1. Prospectors' Camp—Boundary District.
2. Open Cut. Silver Leaf Lithium-bearing Pegmatite—Winnipeg River.
3. Prospectors' Cabin—West Hawk Lake—Boundary District.

volcanic schists occur in smaller scattered areas or bands, associated commonly with the basic volcanic schists.

Among the granitoid intrusive rocks are a gray quartz-diorite on the northern fringe of the district, a coarse hornblende-syenite in an area between Star and Falcon lakes, and a far more abundant reddish-weathering, acid, mica granite which outcrops in great areas to the south and west of the main band of schists. The granite is judged to be later than the quartz-diorite and syenite, or possibly a later product of the same magma, if they all had the same magmatic parent.

Mineral Deposits

A gradation in the metalliferous content of the different types of mineral deposits in the district, as indicated in the following description of these types, indicates a single parent magma as the source of most of them. The similarity of a pegmatitic facies of the abundant granite to a molybdenite-bearing pegmatite, one of the series of types, suggests a genetic relation of the metalliferous deposits with that granite. These suggestions are in keeping with the facts that the Lake of the Woods gold veins show from their paragenesis a relation to some of the Boundary district deposits and have field relations with Lawson's later granite, which is similar to the granite of the Boundary district.

Pegmatite Dikes.—In several parts of the district, but particularly in a belt striking northeast along the western side of the main belt of schists, where these rocks are in contact with the large western granite area, pegmatites are prominent. Dikes and irregular bodies appear in the granite itself, but the pegmatites of economic interest occur in the schist areas, commonly within a few hundred feet of the granite contact. The most prominent type of occurrence is a tabular body, parallel to the foliations of the surrounding schist and outcropping as fairly continuous bands from 1 or 2 to 10 feet or more wide. A few bodies, irregular in width, cut across the schists. The pegmatite of the district is the common one formed from granite magmas. In some parts it is very coarsely grained with individual crystals a foot or more in diameter. In other places the texture is finer and graphic granite may be prominent. The abundant minerals are feldspar, quartz and mica. Muscovite is far more abundant than biotite. Beryl with a yellowish-green color occurs in small crystals in some dikes, and small garnet crystals are not uncommon. Molybdenite is the only prominent metallic mineral found in the pegmatites. It occurs most commonly in crude crystals with widths from ½ inch to 3 inches.

Aggregates of crystals form bunches or pockets in some places. These bunches weigh as much as 20 pounds. Massive fine-grained molybdenite is less abundant.

The principal occurrences of molybdenite-bearing pegmatite are in dikes in schists near the granite contact, about 2 miles north of the west end of Falcon lake. Surface work was done a few years ago on a number of mineral claims in this vicinity. Most work was done on the Gull and Tom Boy claims and these have the best molybdenite showings. The following claims also have pegmatites carrying this mineral and have been developed on the surface in a small way with pits and trenches: Lucky Jack, Union Jack, Smuggler, Winnipeg, Lincoln, Garnet and Ajax. The high prices paid for molybdenum ores during the war made several of these dikes seem promising for economic development. The drop in price at the end of the war had a discouraging effect and no work has been done since that time.

Near the south shore of West Hawk lake and much farther from the granite contact and within the belt of schists than the molybdenite-bearing pegmatites, there is an occurrence of lepidolite and spodumene, two lithia silicates, in a body of pegmatite. The deposit has not been opened up so that little is known about it. No other occurrences of economic minerals in pegmatites have been reported from the district.

Aplite Dikes.—A few narrow dikes of aplite up to 2 or 3 feet in width occur near the molybdenite-bearing dikes north of the west end of Falcon lake. They are made up of small grains of feldspar, quartz, mica and molybdenite, of uniform size. The content of molybdenite varies greatly from place to place in the dikes and is probably nowhere abundant enough to make a workable deposit.

Pegmatitic Quartz Veins.—On two claims, the IXL and Hall, occur veins which consist mainly of quartz but also show more or les pegmatite distributed in bands along the walls. They are best regarded as transition types between true pegmatites and quartz veins. The IXL deposit is in schist about 50 or 100 feet from the granite contact west of Star lake. It outcrops on an island in the muskeg, so that little is showing along the strike. The vein varies from a few inches to 5 or 6 feet in width. A pit was sunk at the widest part. A few inches to a foot of pegmatite occurs along each wall and between these margins the vein is filled with quartz. Molybdenite and bismuthinite are prominent in a width of a few inches along the border between quartz and pegmatite and are in the former rather than the latter vein-stuff. The material of this deposit was not assayed for precious metals.

The Hall deposit is southwest of Star lake and is farther from the granite contact than the IXL deposit. It shows a larger outcrop of quartz and less pegmatite than the latter. The quartz of the Hall deposit carries some values in gold, small amounts of arsenopyrite and molybdenite and a little native bismuth.

The metalliferous content of the IXL and Hall deposits is strikingly similar to that of some of the Lake of the Woods gold veins, such as the Mikado vein on Shoal lake. A genetic relationship with the molybdenite-pegmatites and the prominent granite of the region is strongly suggested.

Molybdenite-Bearing Quartz Veins. — In the vicinity of High lake and the east end of Falcon lake, on both sides of the provincial boundary, there are some interesting occurrences of fine-grained and disseminated molybdenite in quartz. Near the contact of schists and granite, there are some wide bands of felsitic and porphyritic rocks related to the granite. In these bands and in the schists, irregular masses and narrow veins and groups of parallel stringers of quartz are found occupying fissured and sheared zones. The quartz is fine-grained and in many places carries molybdenite in quantities varying between a trace and about 5%. Small grains of pyrite and chalcopyrite are associated with the molybdenite. Samples taken from widths of several feet gave values of over $1 per ton in gold, silver and copper, besides carrying notable amounts of molybdenite.

Tungsten Deposits.—Scheelite has been found in small quantity in many places in the belt of schists that lies to the north of Falcon lake and surrounds Barren, Star and West Hawk lakes. The most prominent occurrences were found in hornblende schists close to the granite contact west of Barren lake. The scheelite is typically associated with high-temperature silicates such as feldspar, epidote, vesuvianite, amphibole and garnet, together with quartz and calcite and more exceptionally molybdenite and ilmenite. Small amounts of pyrrhotite, chalcopyrite and sphene also appear in some of the deposits. These minerals have formed along zones of movement which are indicated by fault-breccias, contortions of the schist and slickensided surfaces on well defined walls. Outcrops, though 6 or 8 feet wide in places, do not hold their width for more than a few feet along the strike, and even in narrow widths are not traced very far. Ore-bearing solutions from the cooling granite magma invaded neighboring schists, depositing scheelite and reacting with the minerals of the schists to develop high-temperature silicates.

In 1918 scheelite was discovered a short distance northeast of the prominent molybdenite area, which lies to the north of

the west end of Falcon lake. The Empress claim was located on a promising-looking outcrop and later other deposits were found in the same belt to the northeast. The outcrop on the Empress was oval in form, and contained a width of over 8 feet showing considerable scheelite in a length of 15 or 20 feet. On being excavated the deposit was found to narrow abruptly in depth as well as at the ends. A small test shipment of nearly 4 tons of hand-sorted material was made from this excavation and from it 177 pounds of scheelite concentrates were obtained. These results were so discouraging that little other work was done on the scheelite-bearing outcrops of the district.

Sulphide Zones in Schist.—North of Falcon lake and in the vicinity of West Hawk lake there are many wide and very long bands of schist which have been extensively impregnated by various kinds of sulphides. Solid sulphides several feet wide occupy parts of the zones. With the solid sulphides are wide bands of schist with sulphides disseminated through them in grains, small bunches and veinlets. The sulphide zones typically follow the laminations of the schists. The prominent sulphides are pyrrhotite and pyrite. Arsenopyrite is commonly present and in some deposits, particularly in the area south of West Hawk lake, it is the chief sulphide. Sphalerite appears in small quantity. Copper stains indicate the presence of copper sulphides in the primary sulphides. Traces of galena are also found. Tin occurs in many of the zones in small amount. It is probably present as sulphide of tin in a mineral resembling chalcopyrite rather than stannite. Scheelite has been found in a number of places in close association with the sulphides of the zones

Gold Occurrences.—Gold-quartz veins have been found at a number of points. Most of them are near the margin of a boss of syenite that outcrops south of Star lake. Gold deposits occur in the syenite itself and in neighboring schists. The marginal arrangement indicates a genetic relation between the gold veins and the syenite intrusive.

Most of the claims showing gold were staked before 1912 and some of them were the earliest staked in Manitoba. Few of the claims show any development work other than pits and shallow shafts. A brief description of a few of the more prominent occurrences will serve to illustrate the main features of the deposits.

The deposit on which most work has been done lies a short distance south of Star lake on the Penniac group of claims. A shear zone in basic schists contains disseminated sulphides and small discontinuous quartz veins. The quartz of the vein is fine-grained and carries varying, but commonly small quantities of pyrite, pyrrhotite, arsenopyrite and free gold. An inclined

shaft was sunk to a depth of 60 feet along the vein and some drifting was done. A mill was erected before attempts had been made to develop an ore-body.

The Sunbeam claim shows a deposit on the fine-grained margin of the northwest side of the syenite boss which lies southeast of Star lake. The outcrop is a fractured and mineralized area of rock with poorly defined boundaries. An area about 100 feet long by 75 feet wide shows fractured rock cemented by veinlets of quartz and carrying pyrite, galena, and sphalerite. Some parts of the deposit contain promising values in gold but insufficient work has been done to show the existence of a workable ore-body.

Deposits on the Waverley and Gold Coin claims are also in the syenite boss, but not far from its margin. Veinlets of quartz, together with grains of pyrite and arsenopyrite and some free gold occur in shear zones in the rock. Values in samples taken from narrow widths of the better mineralized parts of the zone gave fairly high values in gold. Not enough work has been done on either claim to show a workable body.

On the Boyes claim near the northwest end of Barren lake, a gold deposit occurs in basic schist not far west of the south end of the syenite area. The outcrop is traced for a short distance on a hill. A shallow open-cut and a shaft about 25 feet deep were excavated and show two narrow veins of quartz separated by a few inches of rock. The quartz carries arsenopyrite and pyrite and in some parts considerable amounts of free gold.

Other quartz veins in the district are mineralized with chalcopyrite. Some carry massive arsenopyrite and seem to grade into the type described as sulphide zones.

There are other less conspicuous types of deposits in the Boundary district. Perhaps the most interesting one of these is an association of granular massive magnetite with small amounts of chalcopyrite, occurring in narrow veins in an area north of Barren lake.

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